NAWS-CL TP 010

Coso Monitoring Program
October 1996 Through September 1997

by
S. D. Lager
B. R. Johnson
Public Works Department

DECEMBER 1997

NAVAL AIR WEAPONS STATION
CHINA LAKE, CA 93555-6100

Naval Air Weapons Station

FOREWORD

This report presents the status of the Coso Monitoring Program conducted for the period October 1996 through September 1997 by the Naval Air Weapons Station (NAWS), China Lake, Calif. The investigation, funded under the NAWS Coso Geothermal Development Program, is being conducted to provide baseline information on hydrology and surface geothermal activity in the Coso Hot Springs area.

This report was reviewed for technical accuracy by Allan M. Katzenstein and Steven C. Bjornstad (NAWS 83G000D).

Approved by
W. OSTAG
Capt., U.S. Navy
Public Works Officer
17 December 1997

Under authority of
S. DOUGLASS
Capt., U.S. Navy
Commanding Officer

Released for publication by
J. DODD
Capt., U.S. Navy
Director, Shore Station Management

NAWS-CL Technical Publication 010

Published by..... Public Works Department
Collation.....Cover, 25 leaves
First printing.....90 copies

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1997	Final Oct 1996-Sep 1997

4. TITLE AND SUBTITLE
Coso Monitoring Program
October 1996 Through September 1997 (U)

5. FUNDING NUMBERS

6. AUTHOR(S)
S. D. Lager and B. R. Johnson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Air Weapons Station
China Lake, CA 93555-6100

8. PERFORMING ORGANIZATION REPORT NUMBER
NAWS-CL TP 010

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Naval Air Weapons Station
China Lake, CA 93555-6100

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12A. DISTRIBUTION/AVAILABILITY STATEMENT
A Statement; public release, distribution is unlimited.

12B. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

(U) The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (Coso KGRA). A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation; the reader is referred to the 1993/1994 summary report (NAWS-CL TP 006) for detailed descriptions of the overall project and the individual sites monitored.

14. SUBJECT TERMS
Coso Monitoring Program, Steam Flow, Coso Hot Springs, Barometric Pressure, Environmental Monitoring, Water Analysis, Ambient Temperature, Geothermal Development, Water Level, Coso Hot Springs, Relative Humidity

15. NUMBER OF PAGES
48

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

CONTENTS

Figures:

Tables:

INTRODUCTION

The Coso Monitoring Program was initiated in 1978 to gather baseline data on the surface and near-surface geothermal activity at Devils Kitchen and Coso Hot Springs which are the main active thermal features within the Coso Known Geothermal Resource Area (Coso KGRA). These two sites are also located inside the boundaries of the Naval Air Weapons Station (NAWS), China Lake, Calif. This report represents the twentieth consecutive year of continuous data collection at these sites by Geothermal Program Office personnel.

The format of the report for the current reporting period hasn't been changed from last year's report. A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation and the reader is referred to the 1993/1994 summary report (Reference 1) for detailed descriptions of the overall project and the individual sites monitored.

Seasonal and diurnal variations of the thermal activity in these hot spring areas continue to be evident. Overall, the level of activity has been very stable during this reporting period.

Monitoring sites of the Coso Hot Springs area and type of data collected at each site are presented in Table 1. The location of each site is shown in Figure 1.

TABLE 1. Monitoring Functions and Locations.

Monitored sites	Continuous steam flow	Wellhead pressure	Periodic water level	Periodic water temperature	Water level photography	Water chemistry	Ambient temperature	Barometric pressure	Relative humidity	Wind speed and direction
Schober's Resort (Wells 4A-2, 3)	X									
Well 4A-4			X[a]	X						
Well 4H-4	X									
Well 4P-1			X[b]	X		X				
Well 4H-8 (Coso No. 1)		X[c]		X						
Devils Kitchen	X					X				
Observation Well No. 1			X[b]	X		X				
Observation Well No. 2			X[b]							
South Pool			X[b]	X	X	X				
Weather Station							X	X	X	X

[a]Less than weekly monitoring.

[b]Weekly monitoring.

[c]Weekly shut-in wellhead pressures.

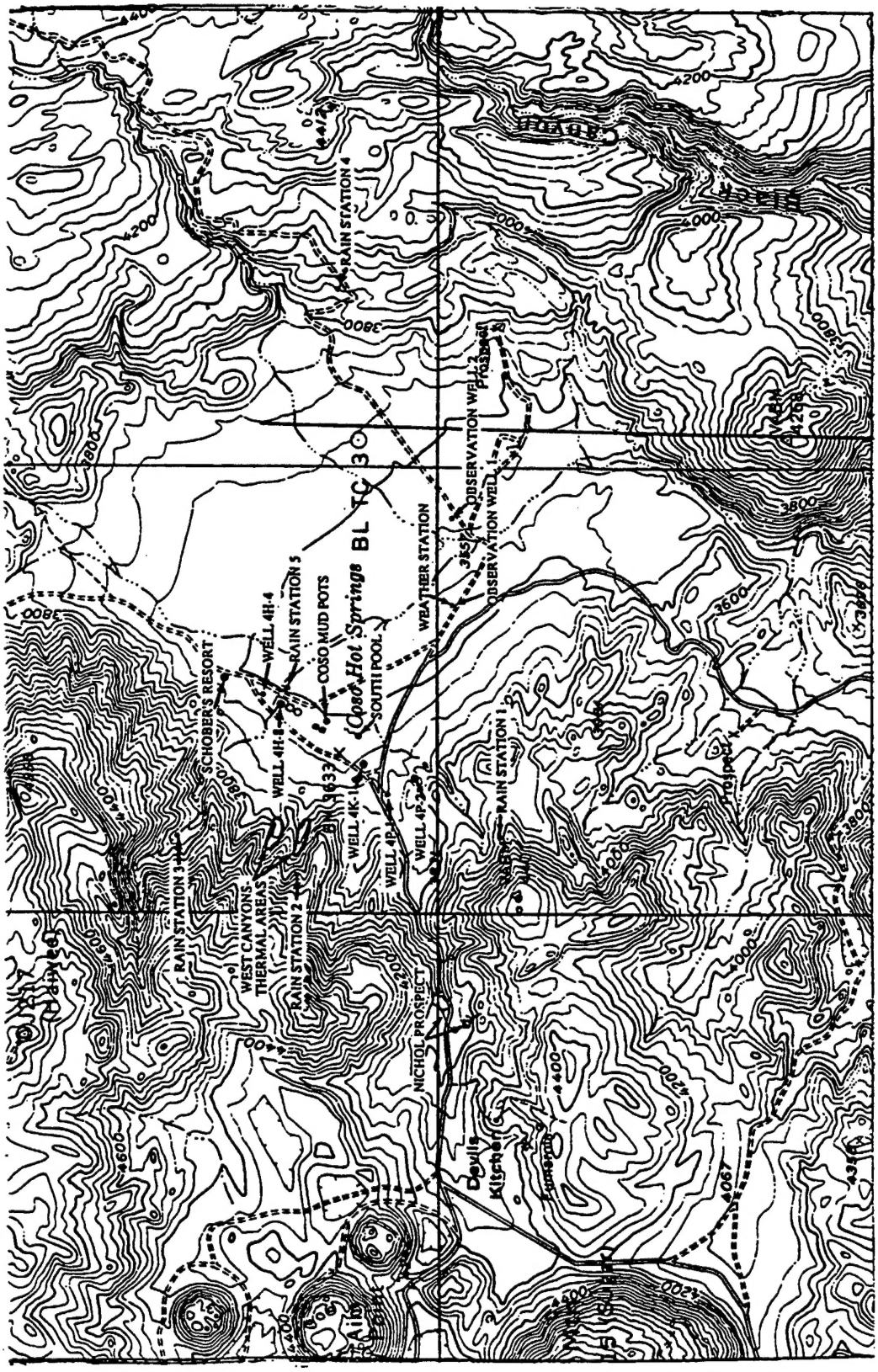


FIGURE 1. Coso Known Geothermal Resources Area Monitoring Sites.

STEAM FLOW AND TEMPERATURE MONITORING

Steam flow has been gauged at several shallow wells since the monitoring program was first initiated. While the measured steam flow from these wells represents an uncertain fraction of the total steam flow from the Coso thermal area, it does serve to monitor the relative hydrothermal activity in the area over time. Several sites are currently included in the study: Devils Kitchen, the Stove Pipe Eight-Inch Well (4H-4), and Schober's Resort (4A-2 and 3).

Steam flow data are recorded at each site using an ITT Barton differential pressure unit AdScan recorder. The data are down-loaded to a pocket-size flash memory card. The information stored in the flash memory card is then transferred into Paradox databases.

A periodic maintenance schedule was established in house to ensure that the recording units are maintained at peak efficiency and reliability. Additionally, a contract was established with ITT Barton for yearly maintenance and calibration of the Barton meter/AdScan units. The AdScan units and the Barton meters were calibrated on 17 April 1997. In August of 1997 the resistor pods, which send the electrical signal to the AdScan unit, were replaced in the Barton meters. Since replacing the resistor pods the AdScan meters have resumed their constant readings.

DEVILS KITCHEN

Steam flow at Devils Kitchen is monitored using a Barton 25-inch water column differential pressure unit (DPU) and AdScan recorder. Daily high, low, and average steam flow data collected at Devils Kitchen for the period of this report are presented in the Appendix. Figure 2 shows a summary graph of Devils Kitchen steam flow activity from October 1996 through September 1997. From late August 1997 through September 1997 the steam flow data recorded at Devils Kitchen (Figure 2) showed a marked increase. The increase does not appear to reflect an actual increase in the steam flow, but may be a mechanical problem in the AdScan recording unit. This situation is still being assessed.

STOVE PIPE EIGHT-INCH STEAM WELL (4H-4)

The daily steam flow for well 4H-4 is presented in the Appendix. This site is equipped with a 50-inch water column DPU and AdScan recorder. Figure 3 shows a summary graph of steam flow activity from October 1996 through September 1997. Data covering the period of 7-10 September 1997 were lost as the result of a data transfer error.

SCHOBER'S WELLS (4A-2 AND 4A-3)

The daily steam flow for wells 4A-2 and 4A-3 at Schober's Resort are presented in the Appendix. This site is equipped with a 50-inch water column DPU and AdScan recorder. Figure 4 shows a summary graph of steam flow activity from October 1996 through 30 September 1997. Data covering the period of 20-26 November 1996 and 10-16 July 1997 were lost as a result of a data transfer error.

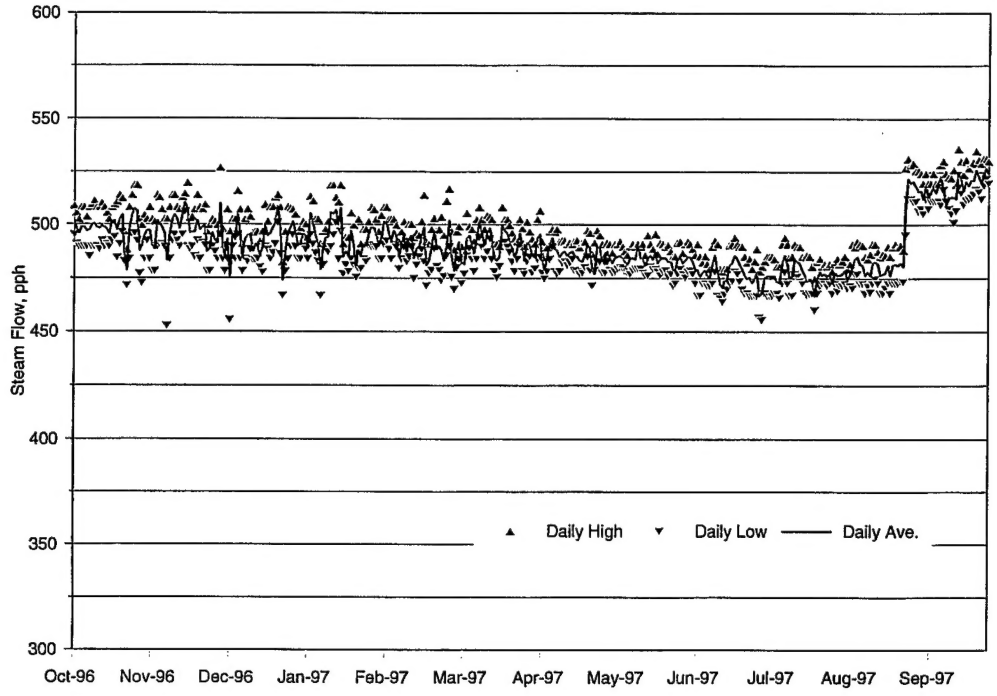


FIGURE 2. Devils Kitchen Steam Flow, October 1996 through September 1997.

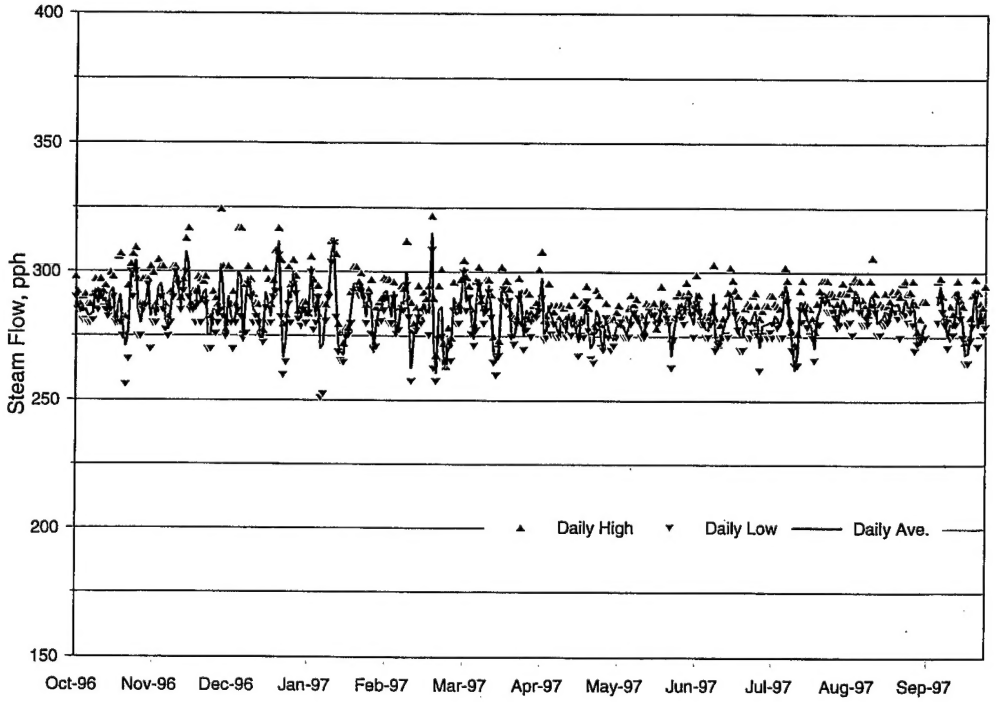


FIGURE 3. Well 4H-4 Steam Flow, October 1996 through September 1997.

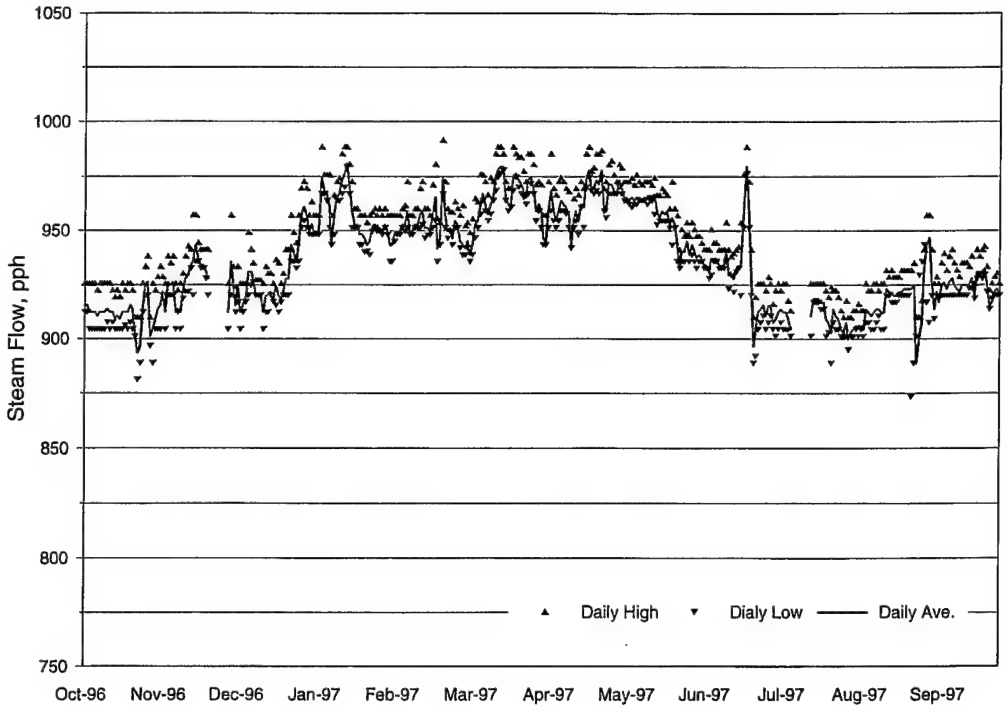


FIGURE 4. Wells 4A-2 and 4A-3 Steam Flow, October 1996 through September 1997.

COSO HOT SPRINGS MUDFIELD PHOTOGRAPHIC RECORD

A weekly photographic record was initiated in January 1978 to document the fluctuation in fluid levels in several of the more prominent mud pots in the Coso KGRA. Over the years the photo record has provided a clear picture of this hot springs thermal activity. It has demonstrated the sensitivity of the hot springs to both seasonal weather changes and individual weather events, such as summer thunderstorms. It has also chronicled the changes in thermal activity that occurred throughout the Coso Hot Springs area in the late 198s. This weekly photo record was continued through this reporting period and is catalogued and stored at the Geothermal Program Office.

Selected photographs, Figures 5 through 13, show the typical level of thermal activity in the hot springs area throughout the past year.

FIGURE 5. Resort Mud Pot Area, August 1997.

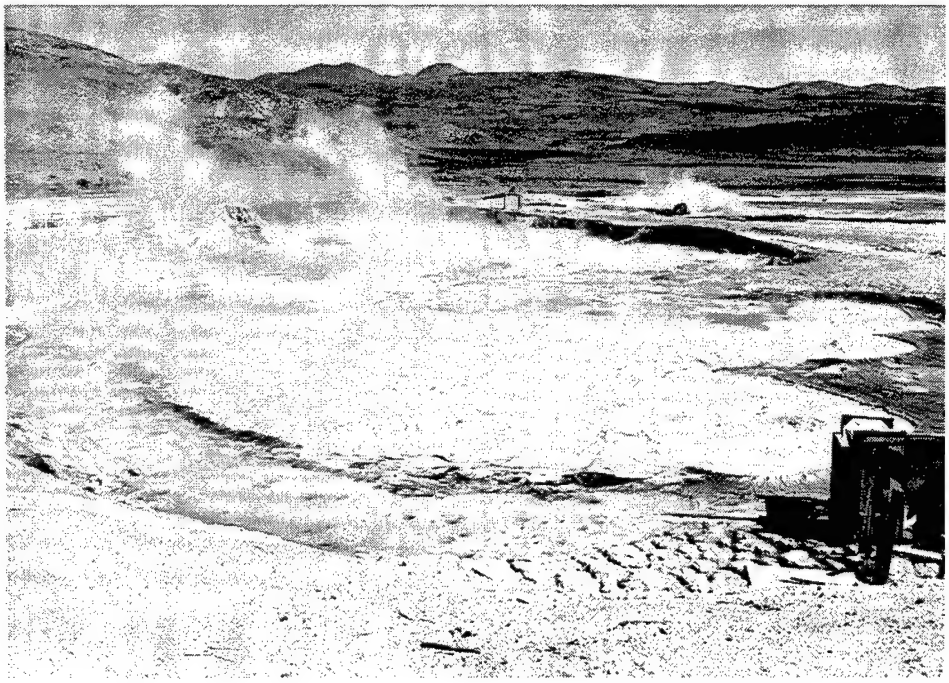


FIGURE 6. South Pool, High Water Level, May 1997.

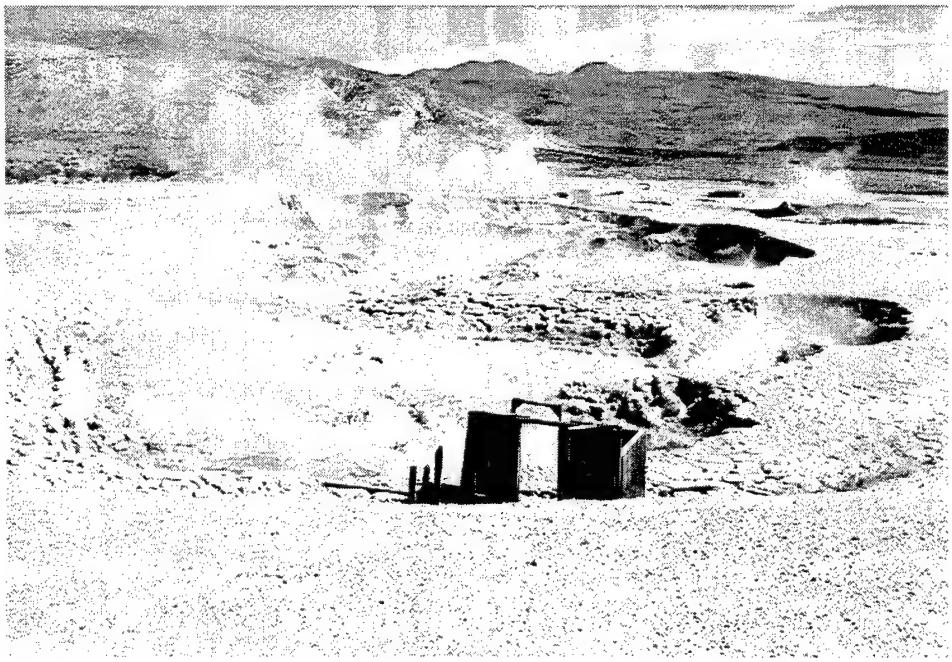


FIGURE 7. South Pool, Low Water Level, October 1996.

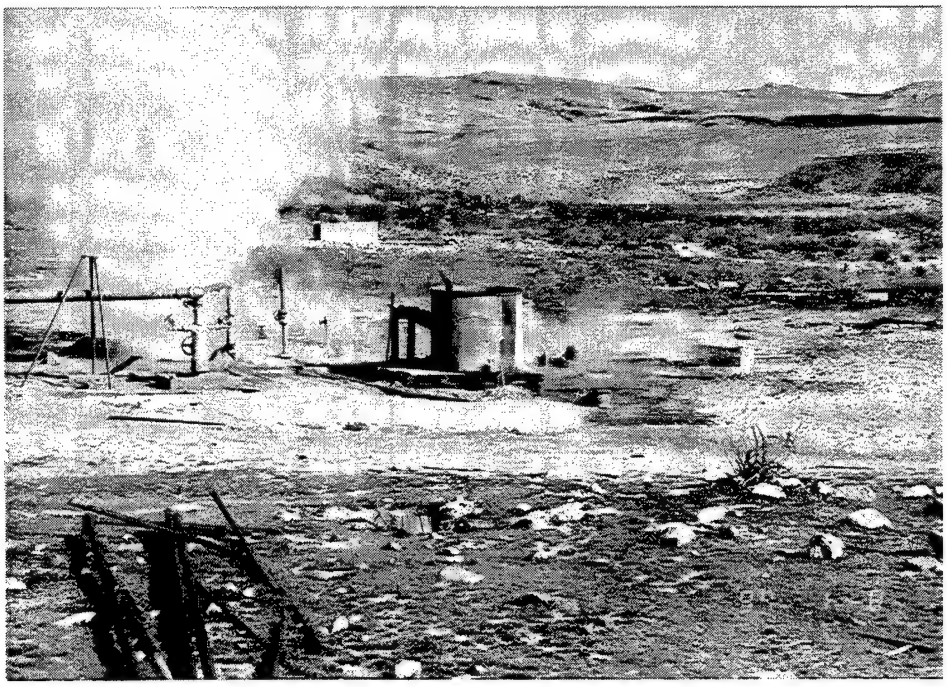


FIGURE 8. Schober's Resort Area.

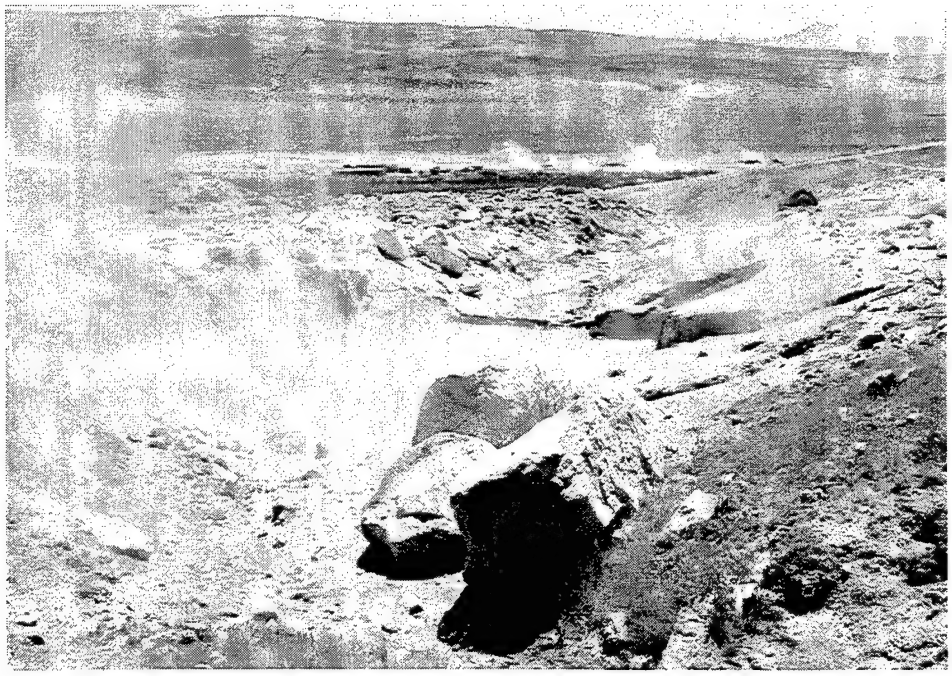


FIGURE 9. West Canyon, Looking East Down Canyon, September 1997.

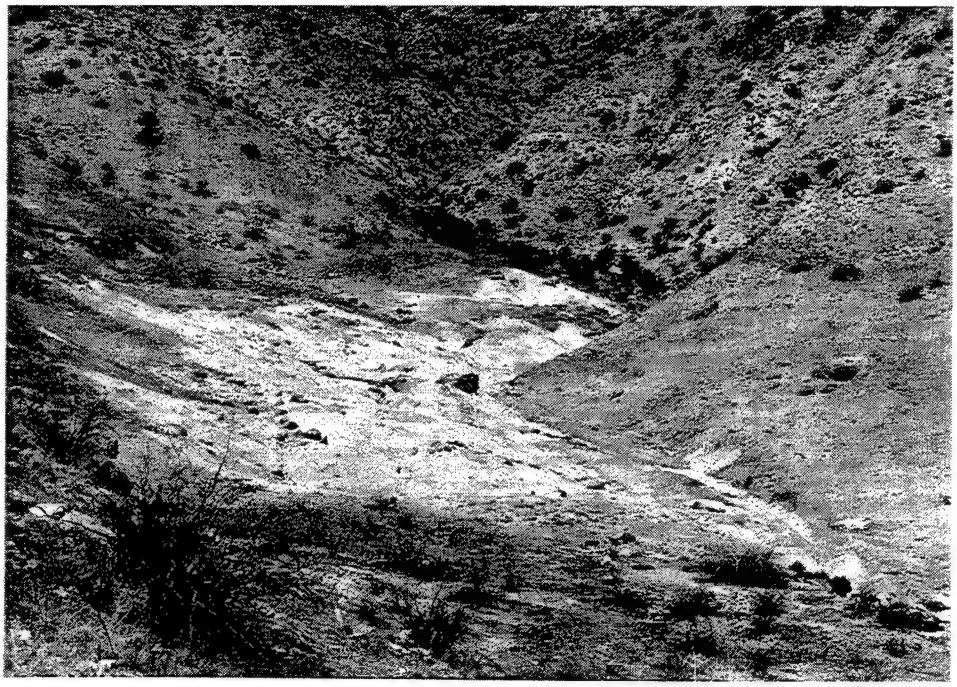


FIGURE 10. Northern West Canyon Land Slump, March 1997.

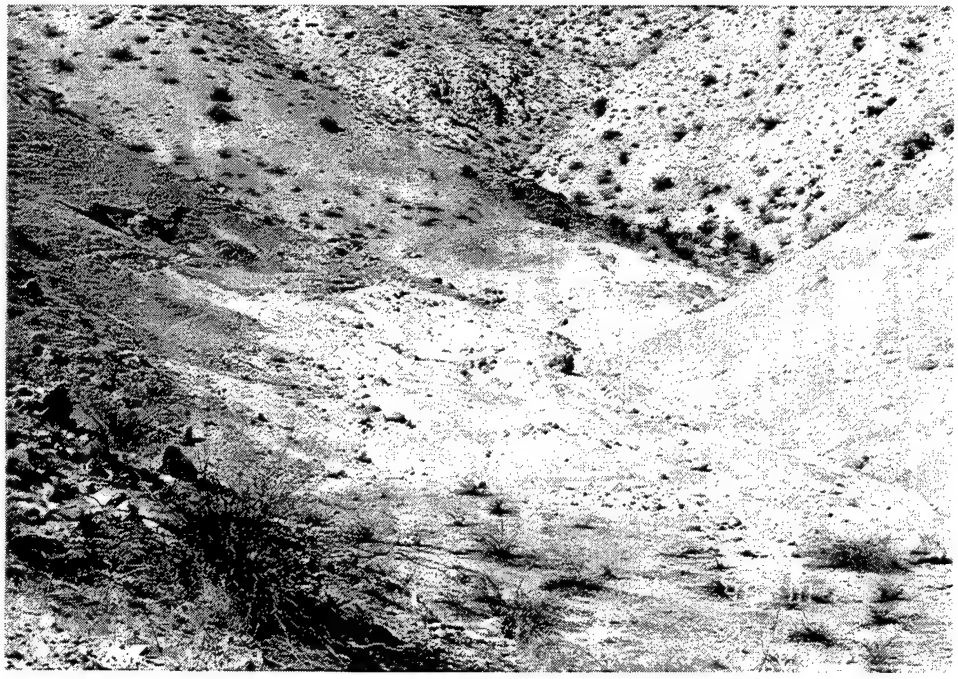


FIGURE 11. Northern West Canyon Land Slump, October 1997.

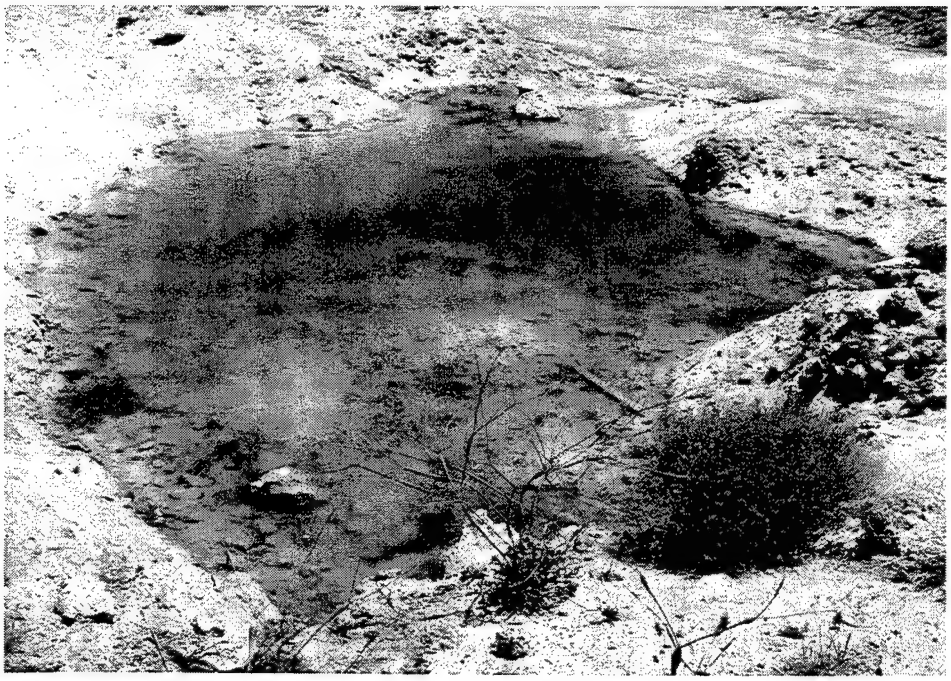


FIGURE 12. Nichol Prospect Warm Pool, March 1997.

FIGURE 13. Nichol Prospect Warm Pool, August 1997.

WATER LEVEL MONITORING

OBSERVATION WELLS

Groundwater levels are monitored in four wells. Bi-weekly measurements are taken at wells 4P-1, OB-1 and OB-2, while the water level of another well, Coso No. 1 (4H-8), is determined indirectly from temperature logs and weekly wellhead pressure readings. These level data are listed in Table 2. Figure 14 shows a summary graph of observation well water levels from 1980 to the present. Depth to water data have been translated to true elevation.

The fluid level elevation in well 4P-1 appears to have stabilized at 3613.3 feet above sea level (ASL) during this monitoring period. Well 4P-1 is a hot, steam condensate well and is located on the upthrown side of the Coso Hot Springs fault, about 150 feet from the fault line, toward the south end of the hot springs area. It is completed in alluvial fill material. As discussed in Reference 2, this well appears to tap a small perched aquifer that is not directly connected to the regional aquifer.

Observation wells OB-1 and OB-2 are water wells located in the Upper Coso Basin about three-quarters of a mile east of the fault line. Both of these wells are completed in sedimentary, valley fill material. The water level elevation in OB-1 continues the decline described in previous reports, dropping from about 3432 feet ASL in 1988 to about 3385.6 feet ASL by September 1997. The water level in OB-2, however, rose about 10 feet during 1989 and 1990. This level appears to have stabilized at about 3365.5 feet ASL.

Coso No. 1 is located toward the north end of the Coso Hot Springs fault and is completed in bedrock. The fluid level in Coso No. 1 declined slightly from 3473 to about 3465 feet ASL between 1978 and October 1987. At that lowered fluid level, the well began to boil. The fluid level dropped rapidly to about 3410 feet ASL by September 1988, and the wellbore became plugged with salt and scale. Coso No. 1 was rehabilitated in 1993 and shut-in to reduce boiling and scaling. The current fluid level (determined from the temperature gradient log) is at about 3294 feet ASL.

Shut-in wellhead pressures for Coso No. 1 are recorded weekly from both the 4-inch wellbore and the 7-inch intermediate casing around the wellbore. The wellbore is completed to 370 feet in bedrock, while the intermediate casing is set to 194 feet at the alluvium/ bedrock interface. Table 3 is a listing of the current year's recorded pressures. Figure 15 is a summary graph of these pressures from November 1993 to the present.

TABLE 2. Observation Well Water Level Data.

Date	Water level elevations, ft, above mean sea level (AMSL)			
	Ground level at well location, ft, AMSL			Ground level, ft, AMSL
	4P-1	OB-1	OB-2	Coso 1
	3662.0	3570.0	3560.0	3615.0
	Water level measurements			Water level
	4P-1	OB-1	OB-2	Coso 1
2 Oct 96	3613.3	3385.6	3365.5	
9 Oct 96	3613.3	3385.6	3365.5	
16 Oct 96	3612.1	3385.6	3365.5	
23 Oct 96	3613.3	3385.6	3365.5	
30 Oct 96	3613.3	3386.8	3365.5	
6 Nov 96	3613.3	3386.8	3365.5	
13 Nov 96	3613.3	3386.8	3365.5	
20 Nov 96	3613.3	3386.8	3365.5	
27 Nov 96	3613.3	3386.8	3365.5	
4 Dec 96	3613.3	3386.8	3365.5	
11 Dec 96	3612.1	3387.9	3364.3	
18 Dec 96	3612.1	3385.6	3365.5	
26 Dec 96	3612.1	3385.6	3365.5	
2 Jan 97	3612.1	3385.6	3365.5	
8 Jan 97	3612.1	3385.6	3365.5	
16 Jan 97	3612.1	3385.6	3365.5	
23 Jan 97	3612.1	3385.6	3365.5	
5 Feb 97	3613.3	3384.5	3365.5	
12 Feb 97	3612.1	3385.6	3365.5	
19 Feb 97	3612.1	3384.5	3364.3	
26 Feb 97	3613.3	3385.6	3364.3	
5 Mar 97	3613.3	3384.5	3365.5	
12 Mar 97	3612.1	3386.8	3365.5	
19 Mar 97	3614.5	3383.8	3364.3	
26 Mar 97	3613.3	3384.5	3365.5	3294.0
2 Apr 97	3612.1	3385.6	3365.5	
9 Apr 97	3612.1	3385.6	3365.5	
17 Apr 97	3613.3	3384.5	3365.5	
24 Apr 97	3613.3	3385.6	3365.5	
30 Apr 97	3613.3	3385.6	3365.5	

TABLE 2. (Contd.)

Date	Water level elevations, ft, AMSL			
	Ground level at well location, ft, AMSL			Ground level, ft, AMSL
	4P-1	OB-1	OB-2	Coso 1
	3662.0	3570.0	3560.0	3615.0
	Water level measurements			Water level
	4P-1	OB-1	OB-2	Coso 1
7 May 97	3613.3	3385.6	3365.5	
14 May 97	3613.3	3385.6	3365.5	
21 May 97	3613.3	3385.6	3365.5	
28 May 97	3613.3	3385.6	3365.5	
4 Jun 97	3613.3	3385.6	3365.5	
11 Jun 97	3613.3	3385.6	3364.3	
18 Jun 97	3613.3	3385.6	3364.3	
25 Jun 97	3613.3	3385.6	3364.3	
2 Jul 97	3613.3	3384.5	3365.5	
9 Jul 97	3613.3	3385.6	3365.5	
16 Jul 97	3613.3	3385.6	3365.5	
23 Jul 97	3613.3	3385.6	3364.3	
30 Jul 97	3613.3	3385.6	3364.3	
6 Aug 97	3613.3	3385.6	3364.3	
13 Aug 97	3613.3	3385.6	3365.5	
20 Aug 97	3613.3	3385.6	3365.5	
27 Aug 97	3613.3	3385.6	3365.5	
3 Sep 97	3613.3	3385.6	3365.5	
10 Sep 97	3613.3	3385.6	3365.5	
17 Sep 97	3613.3	3385.6	3365.5	
24 Sep 97	3613.3	3385.6	3365.5	

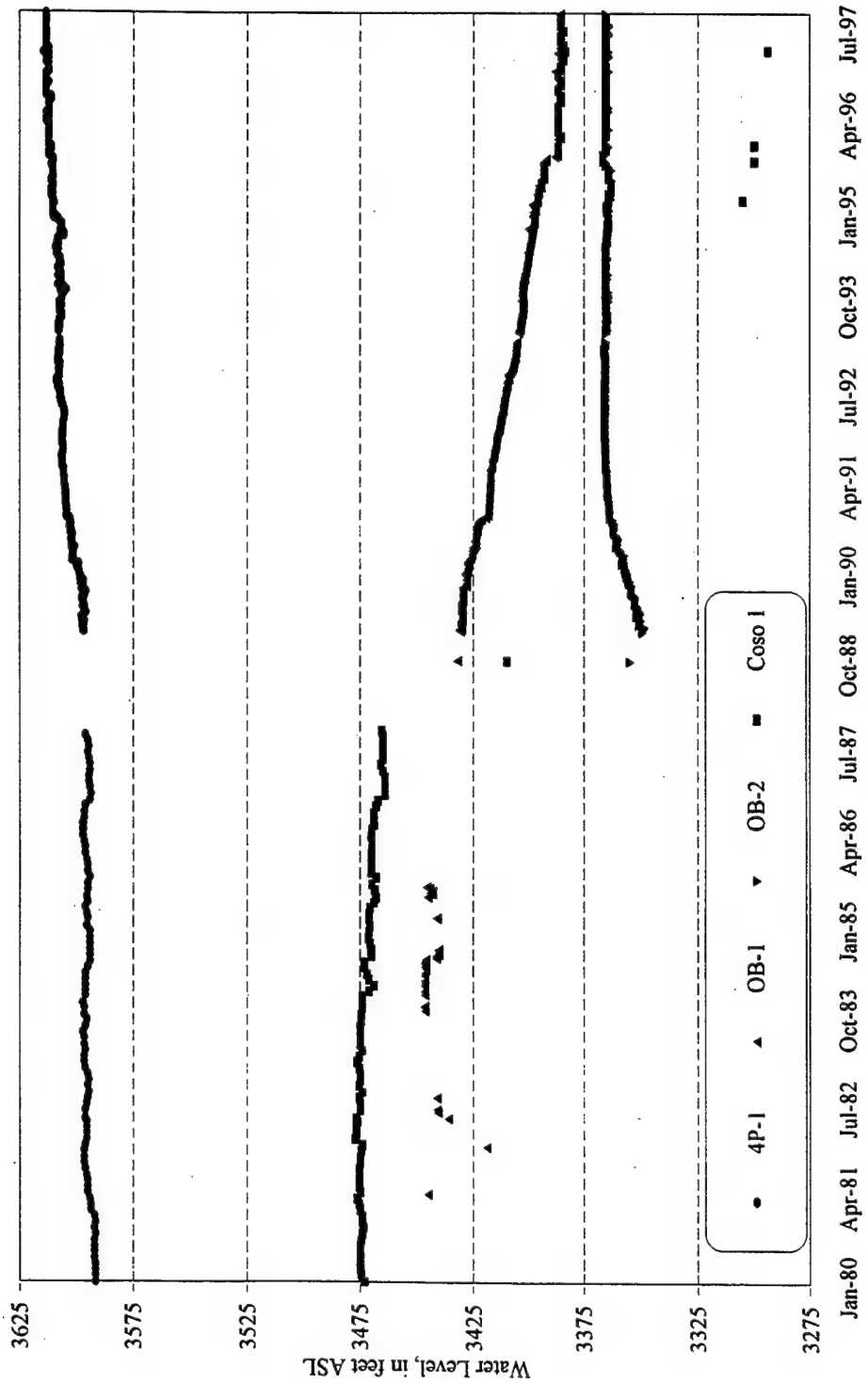


FIGURE 14. Water Levels in Coso Observation Wells, January 1980 Through September 1997.

TABLE 3. Shut-in Wellhead Pressure, Coso No. 1.

Date	7-inch Casing (psig)	4-inch Casing (psig)
2 Oct 96	24.5	20.5
9 Oct 96	24.5	20.5
16 Oct 96	25.0	20.5
23 Oct 96	24.5	20.5
30 Oct 96	24.5	20.5
6 Nov 96	24.5	20.5
13 Nov 96	25.0	20.5
20 Nov 96	24.5	20.5
27 Nov 96	24.5	20.5
4 Dec 96	24.5	20.5
11 Dec 96	24.5	20.5
18 Dec 96	24.5	20.5
26 Dec 96	25.0	20.5
2 Jan 97	24.5	20.5
8 Jan 97	24.5	20.5
16 Jan 97	24.5	20.5
23 Jan 97	25.0	20.5
5 Feb 97	25.0	20.5
12 Feb 97	25.0	20.5
19 Feb 97	25.0	20.5
26 Feb 97	24.5	20.5
5 Mar 97	24.5	20.5
12 Mar 97	25.0	20.5
19 Mar 97	25.0	20.5
26 Mar 97	25.0	20.5
2 Apr 97	25.0	20.5
9 Apr 97	25.0	20.5
17 Apr 97	25.0	20.5
24 Apr 97	24.5	20.5
30 Apr 97	25.0	20.5
7 May 97	25.0	20.5
14 May 97	25.0	21.0
21 May 97	25.5	21.0
28 May 97	25.5	21.0
4 Jun 97	25.5	21.0
11 Jun 97	25.5	21.0
18 Jun 97	25.5	21.0
25 Jun 97	25.5	21.0
2 Jul 97	25.5	21.0
9 Jul 97	25.5	21.0
16 Jul 97	25.5	21.0
23 Jul 97	25.5	21.0
30 Jul 97	25.5	21.0
6 Aug 97	25.0	20.5
13 Aug 97	25.0	21.5
20 Aug 97	25.0	21.5
27 Aug 97	25.0	21.5
3 Sep 97	25.0	21.5
10 Sep 97	25.5	21.0
17 Sep 97	25.5	21.0
24 Sep 97	25.5	21.0

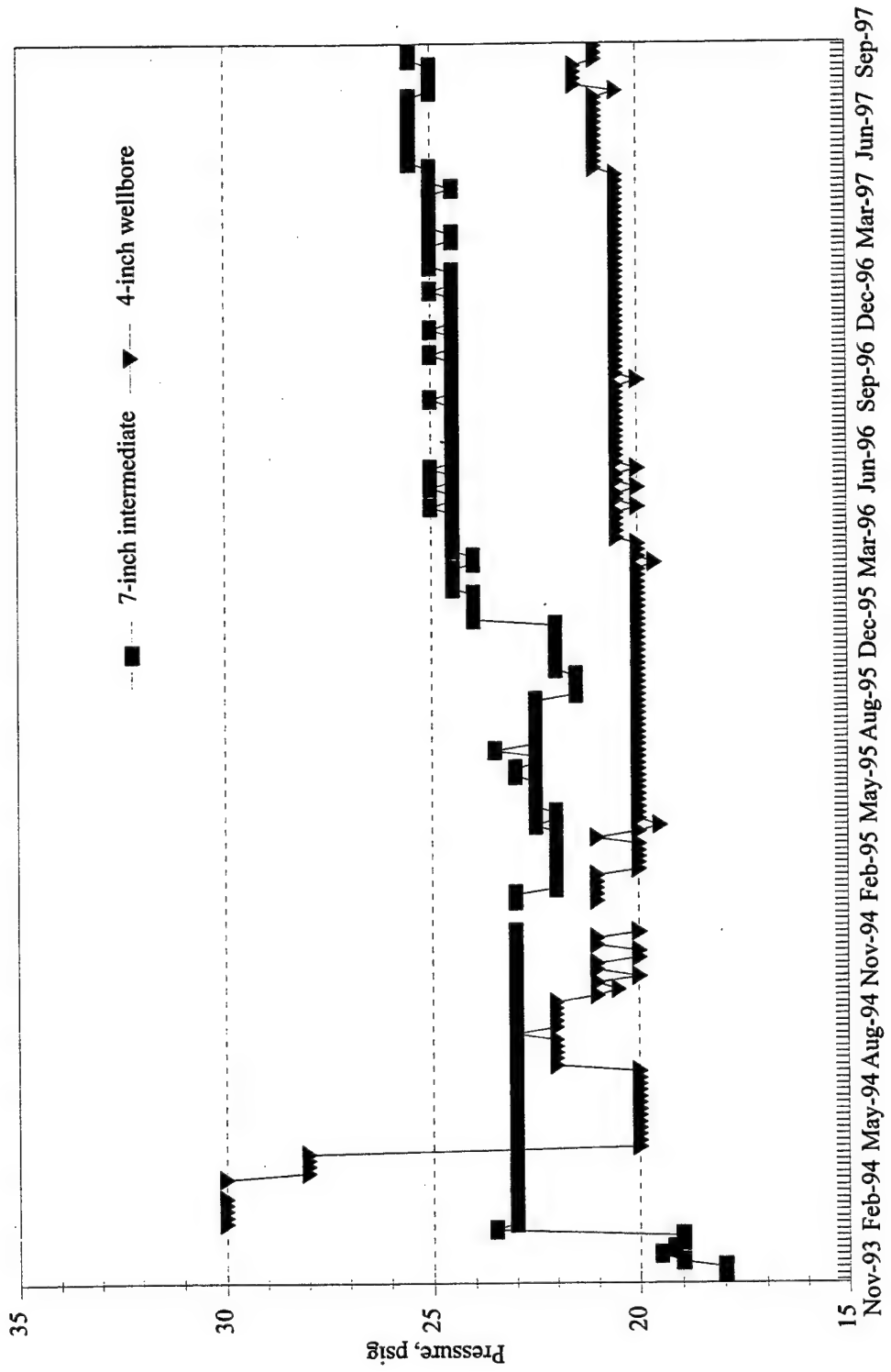


FIGURE 15. Shut-in Wellhead Pressure, Coso Well No. 1, November 1993 to September 1997.

SOUTH POOL

The South Pool water level has continued the pattern of seasonal fluctuations throughout this reporting period, ranging from a low of 3612.2 feet in October 1996 to a high of 3620.7 feet in February of 1997 (Table 4). The pool's temperature is periodically measured, as conditions permit. Water temperatures for this period continued to average above 200 degrees Fahrenheit. The temperature and water elevations of the pool for January 1988 through September 1997, the period of increased activity, are shown graphically in Figure 16, while the pool elevation recorded for the entire monitoring program period is shown in Figure 17.

TABLE 4. South Pool Elevation and Temperature Changes.

Date	Elevation ft	Temperature °F	Date	Elevation ft	Temperature °F
2 Oct 96	3616.5	212	9 Apr 97	3620.3	206
9 Oct 96	3616.7	210	17 Apr 97	3620.3	205
16 Oct 96	3616.9	211	24 Apr 97	3620.2	204
23 Oct 96	3617.2	210	30 Apr 97	3620.0	205
30 Oct 96	3617.6	211	7 May 97	3619.8	206
6 Nov 96	3617.9	209	14 May 97	3619.6	204
13 Nov 96	3618.4	206	21 May 97	3619.6	205
20 Nov 96	3618.6	207	28 May 97	3619.8	205
27 Nov 96	3618.7	205	4 Jun 97	3618.5	206
4 Dec 96	3619.3	202	11 Jun 97	3618.4	204
11 Dec 96	3619.3	204	18 Jun 97	no data	193
18 Dec 96	3619.5	204	25 Jun 97	no data	194
26 Dec 96	3619.6	208	2 Jul 97	6318.5	no data
2 Jan 97	3619.5	204	9 Jul 97	6318.5	no data
8 Jan 97	3619.5	210	16 Jul 97	no data	no data
16 Jan 97	3620.1	202	23 Jul 97	3618.4	212
23 Jan 97	3620.3	206	30 Jul 97	3618.4	212
5 Feb 97	3620.4	205	6 Aug 97	3618.2	212
12 Feb 97	3620.3	210	13 Aug 97	3618.0	213
19 Feb 97	3620.4	207	20 Aug 97	3617.9	211
26 Feb 97	3620.7	205	27 Aug 97	3617.8	no data
5 Mar 97	3620.6	208	3 Sep 97	3617.9	210
12 Mar 97	3620.4	210	10 Sep 97	3617.7	211
19 Mar 97	3620.4	205	17 Sep 97	3617.7	211
26 Mar 97	3620.3	201	24 Sep 97	3617.8	211
2 Apr 97	3620.4	204			

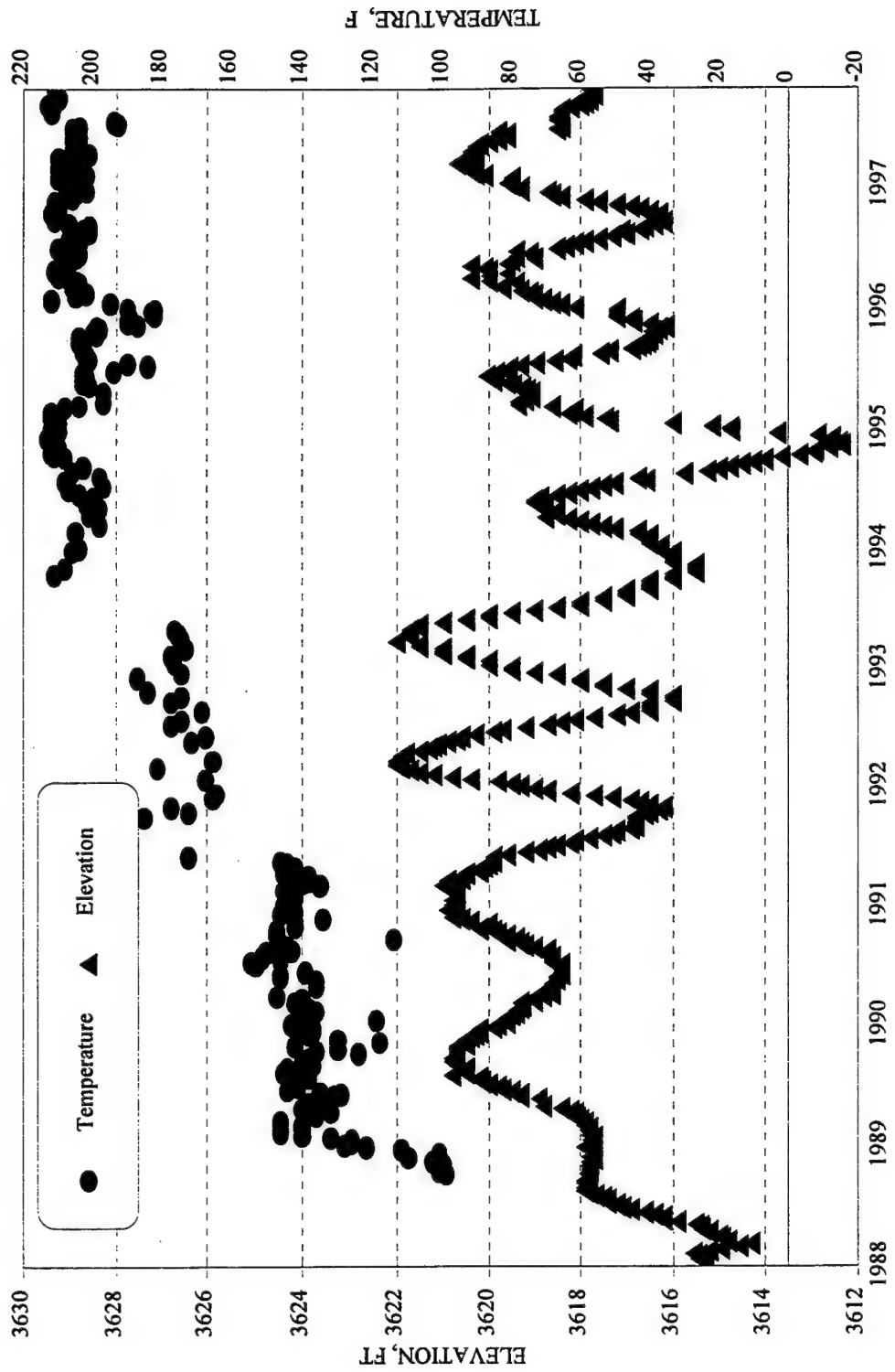


FIGURE 16. South Pool Elevation and Temperature, January 1988 Through September 1997.

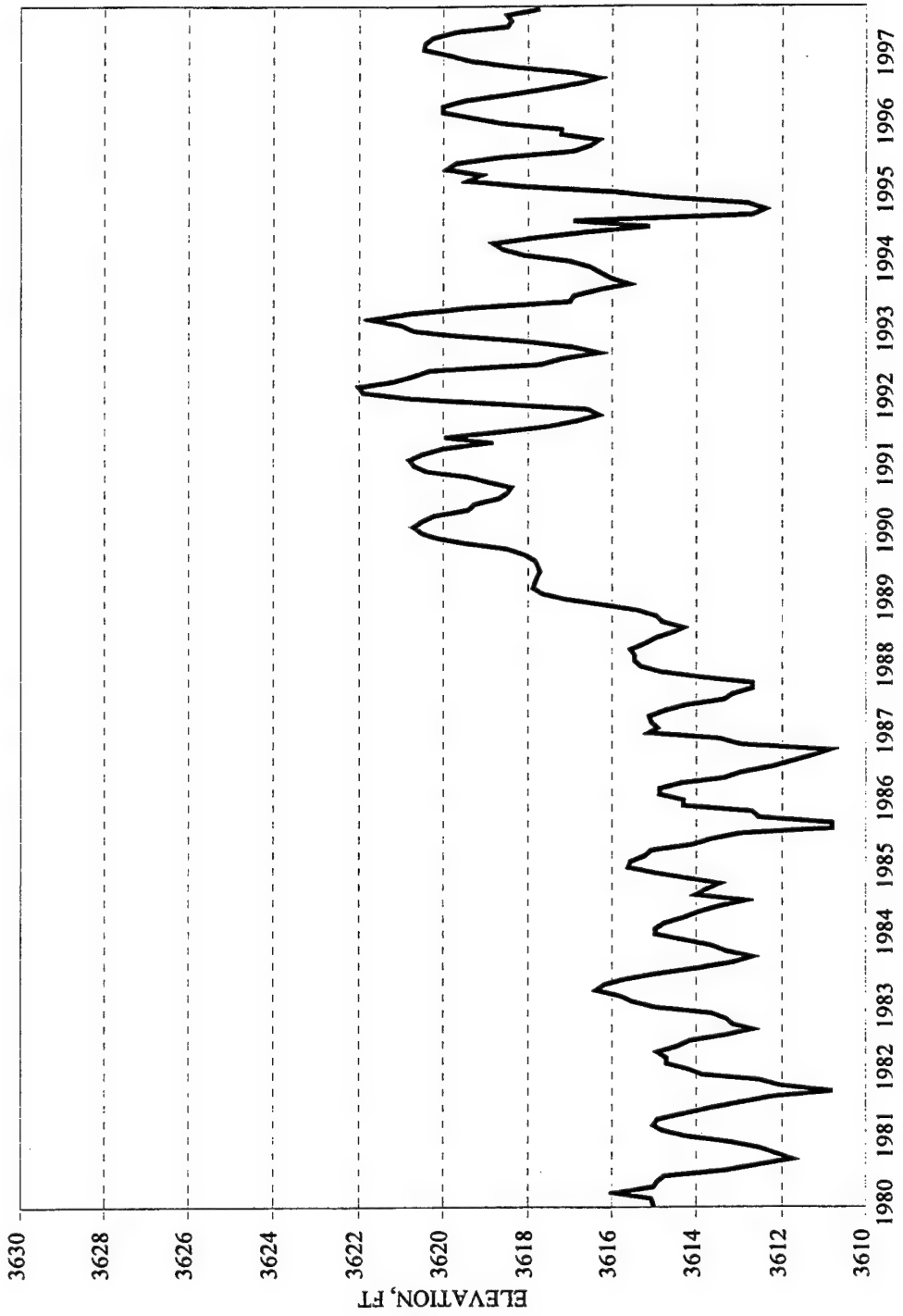


FIGURE 17. South Pool Elevations, 1980 Through September 1997.

RAINFALL AT COSO RESORT AREA AND ROSE VALLEY

Rainfall in the Coso Hot Springs basin is monitored at five rain station sites, as mapped in Figure 1. Instrumentation at each site consists of a battery-operated long-term strip recorder that is triggered by a tipping bucket. No rain data were recorded in tipping buckets 2 and 3 for the months of June 1997 and September 1997 due to mechanical problems. The Rose Valley data are collected at the Los Angeles Department of Water and Power Haiwee Reservoir Plant.

Data from the Coso rain stations and the Rose Valley data from the Haiwee power plant are presented in Table 5 and Figure 18. Comparative rainfall data for Coso Basin, Rose Valley, and the Indian Wells Valley (IWV) for the period 1966 through 1996 are shown in Table 6 and Figure 19. IWV data were gathered at Armitage Field, Naval Air Warfare Center Weapons Division (NAWCWPNS), and provided by a NAWCWPNS meteorologist.

TABLE 5. Rainfall Recorded at the Coso Rain Stations and Rose Valley.

Coso Hot Springs area						Rose Valley	
Date	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
						30 Oct 96	0.15
						31 Oct 96	0.25
21 Nov 96					0.04		
						22 Nov 96	0.56
9 Dec 96	0.63	0.43	0.32	0.38	0.10		
10 Dec 96	0.03					10 Dec 96	0.39
11 Dec 96	0.10	0.11	0.09		0.02	11 Dec 96	0.26
						12 Dec 96	0.07
22 Dec 96	0.32	0.23	0.19	0.21	0.06	22 Dec 96	0.23
						23 Dec 96	0.4
25 Dec 96				0.08			
27 Dec 96	0.03	0.60	0.80		0.04	27 Dec 96	0.2
						28 Dec 96	0.02
30 Dec 96	0.04	0.70	0.90		0.08		
31 Dec 96	0.01						
						1 Jan 97	0.03
2 Jan 97	0.02					2 Jan 97	0.23
6 Jan 97	0.04						
						13 Jan 97	0.12
15 Jan 97	0.02	0.80	0.12		0.05	15 Jan 97	0.15
16 Jan 97	0.05						
						21 Jan 97	0.02
22 Jan 97					0.02		

TABLE 5. (Contd.)

Coso Hot Springs area						Rose Valley	
Date	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
23 Jan 97	0.02					23 Jan 97	0.04
24 Jan 97		0.10	0.11				
25 Jan 97					0.11		
26 Jan 97	0.11					26 Jan 97	0.21
18 May 97					0.01		
						19 May 97	0.05
20 May 97	0.01						
5 Jun 97				0.28	0.32		
						6 Jun 97	0.38
7 Jun 97	0.14						
13 Jun 97				0.08	0.09		
15 Jun 97	0.11			0.10	0.02	15 Jun 97	0.22
16 Jun 97	0.13						
22 Jul 97	0.14			0.18	0.16		
						23 Jul 97	0.63
28 Jul 97					0.03		
						29 Jul 97	0.16
2 Sep 97	0.09			0.05	0.08	2 Sep 97	0.67
25 Sep 97	1.05			1.38	1.44	25 Sep 97	0.45
						26 Sep 97	1.48
TOTAL	3.09	2.97	2.53	2.74	2.67	TOTAL	7.37

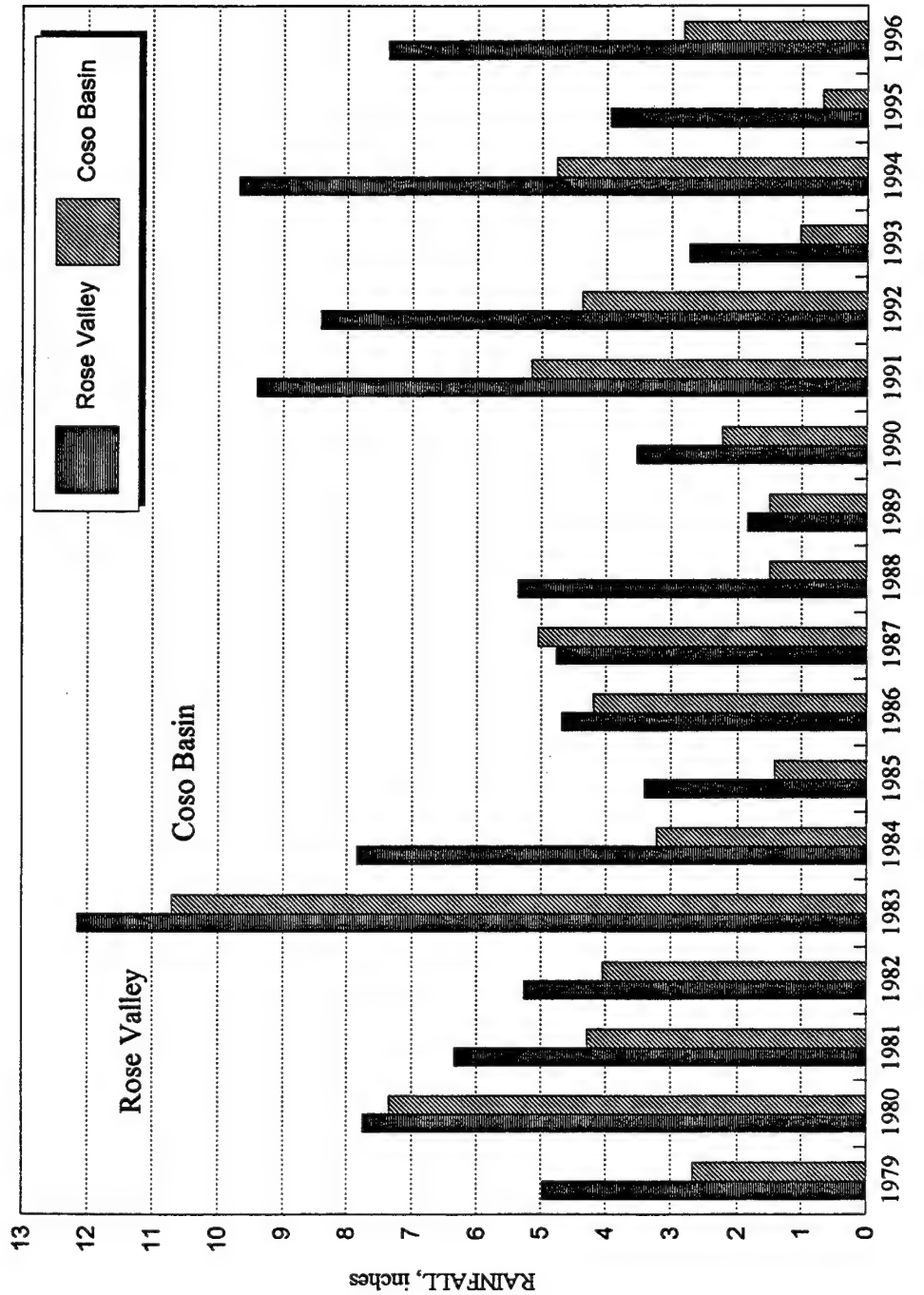


FIGURE 18. Comparison of Total Rainfall at Coso Basin and Rose Valley, 1986 Through 1996.

TABLE 6. IWV, Rose Valley, and Coso Basin Rainfall.

Year	IWV	Rose Valley	Coso Basin
1967	4.28	4.32	
1968	3.16	3.26	
1969	5.55	8.80	
1970	3.74	6.45	
1971	1.47	2.87	
1972	1.24	1.90	
1973	2.58	4.56	
1974	7.46	9.19	
1975	1.64	2.79	
1976	3.74	8.50	
1977	4.67	8.34	
1978	10.68	12.61	
1979	5.56	4.97	2.67
1980	6.31	7.75	7.34
1981	4.49	6.34	4.28
1982	4.73	5.26	4.05
1983	10.56	12.14	10.70
1984	5.95	7.84	3.23
1985	1.29	3.42	1.42
1986	3.68	4.68	4.19
1987	4.43	4.77	5.04
1988	3.76	5.36	1.51
1989	0.94	1.85	1.51
1990	1.78	3.53	2.24
1991	7.83	9.41	5.15
1992	8.10	8.4	4.38
1993	0.94	2.74	1.04
1994	6.76	9.69	4.78
1995	7.88	3.94	0.69
1996	2.82	7.37	2.83

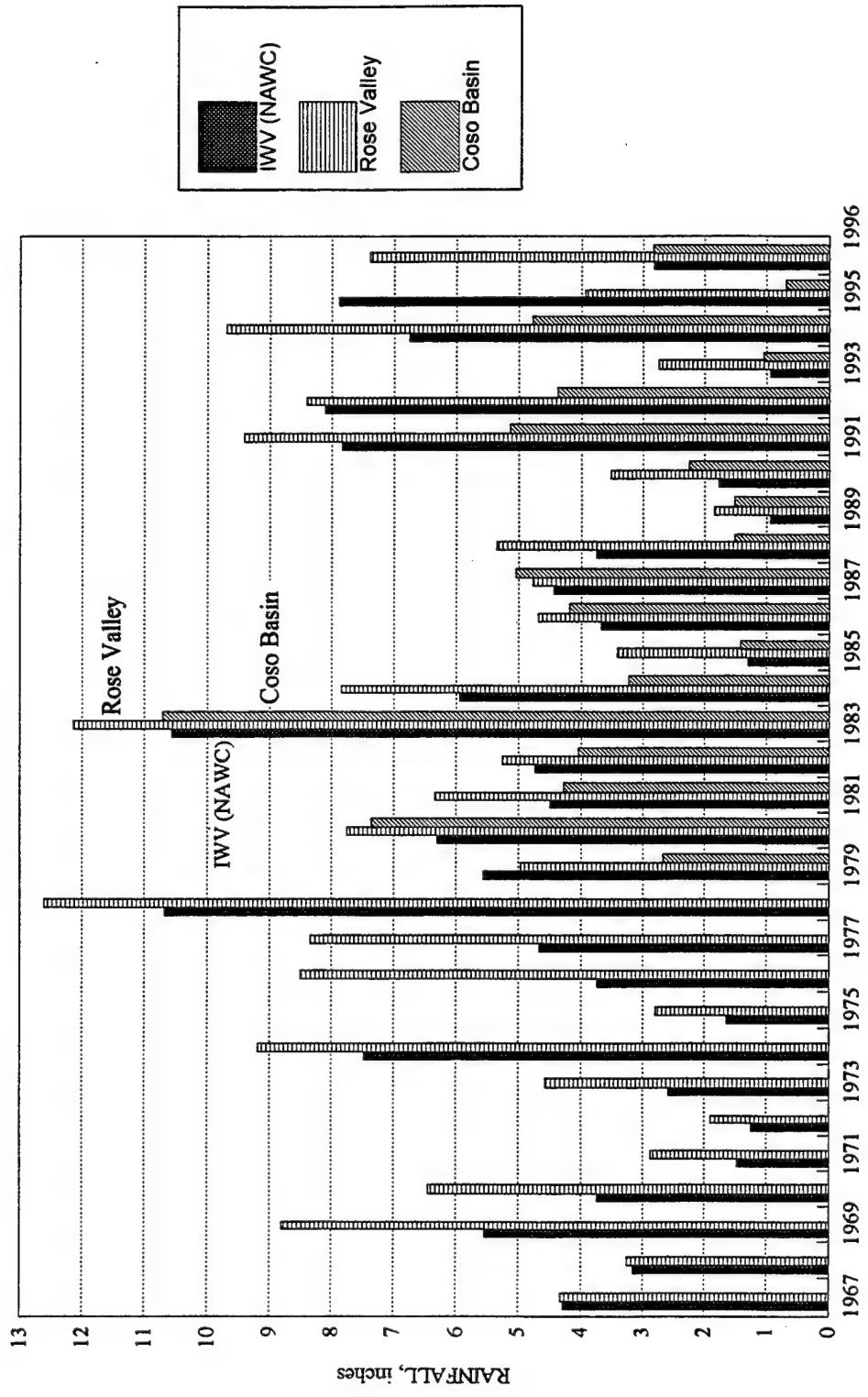


FIGURE 19. Comparison of Total Rainfall at Coso Basin, Rose Valley, and NAWC Sites, 1966 Through 1996.

COSO HOT SPRINGS MINI-WEATHER RECORDING STATION

Barometric pressure, ambient temperature, relative humidity, and wind speed and wind direction are recorded at Weather Station 1, located adjacent to observation well OB-1. In March 1996 this station was integrated into the base wide weather monitoring network. This site is now maintained by NAWCWPNS Geophysics Operation personnel (Code 521410D).

Barometric pressure, ambient temperature, and relative humidity data are presented in Figure 20. Actual hourly data are expansive and will not be published. It is available from the Geothermal Program Office upon request.

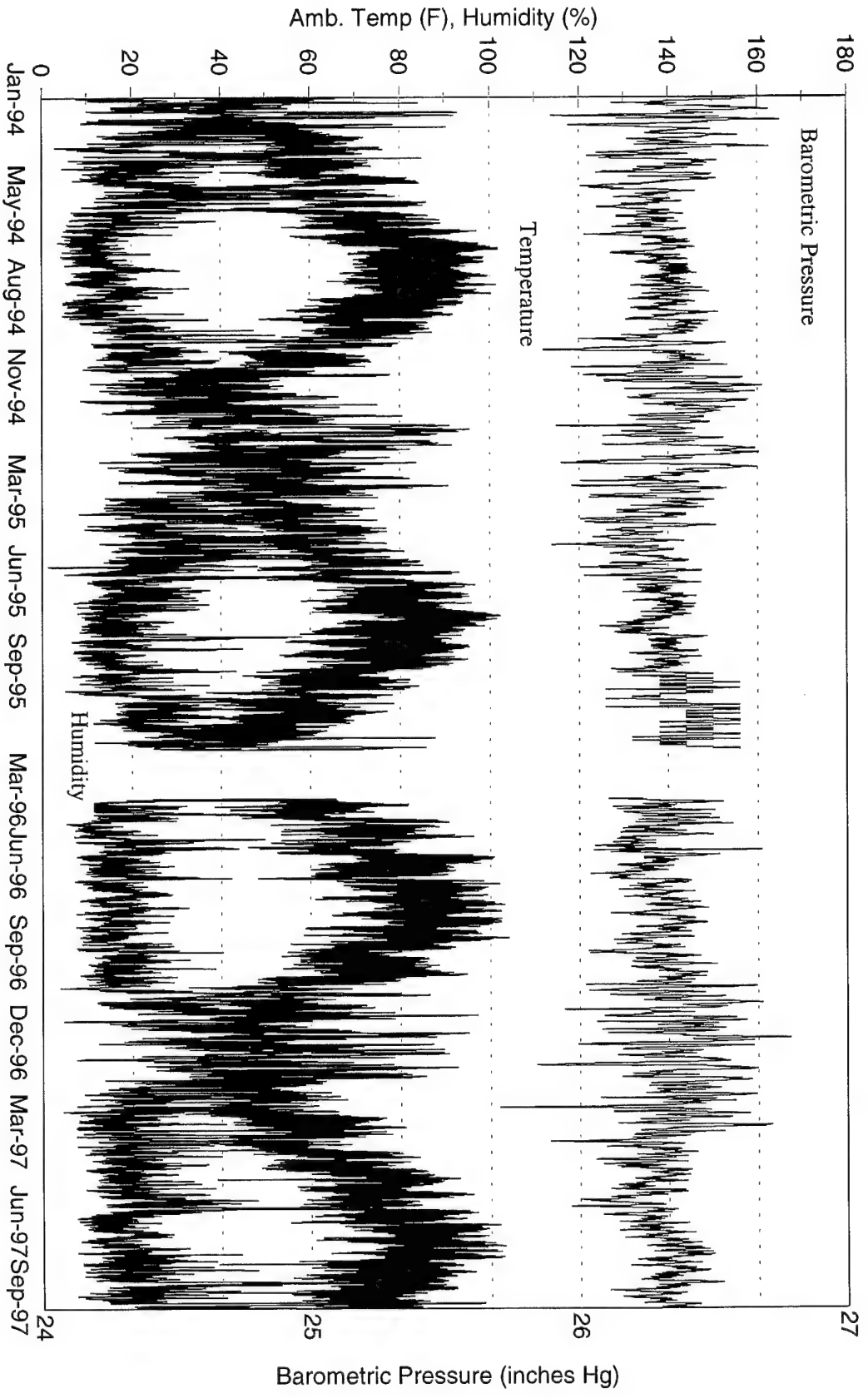


FIGURE 20. Weather Station One, Hourly Data, 19 January 1994 Through 30 September 1997.

WATER ANALYSIS OF COSO HOT SPRINGS AREA

Water samples were collected from several sites in the Coso Hot Springs area. These samples were analyzed for a suite of geothermal constituents by NAWCWPNS' Environmental Analysis Facility (Codes 4B2300D/474230D). The results are provided in Table 7. Wells 4K-1, 4P-1, and OB-1, as well as sites at Devils Kitchen, South Pool, West Canyon, and the Nichol Pool, were analyzed.

Constituents	Units	OB-1 8/18/97	4K-1 3/24/97	4K-1 8/15/97	4P-1 3/24/97	4P-1 8/15/97	Devils Kitchen 3/24/97	Devils Kitchen 8/15/97	Nichol Pool 3/24/97	Nichol Pool 8/15/97	South Pool 3/24/97	South Pool 8/15/97	West Canyon 3/24/97	West Canyon 8/15/97
Aluminum	mg/L	a	a	a	a	a	9.84	12.6	2.74	2.19	24.3	1.03	0.654	6.84
Antimony	mg/L	a	a	0.11	a	0.23	a	a	a	0.16	a	a	a	0.13
Arsenic	mg/L	a	a	0.29	a	0.15	a	0.36	0.86	0.65	a	0.19	a	0.33
Bicarbonate	mg/L	212	30	44.5	86	65.9	a	a	a	a	a	a	a	a
Boron	mg/L	23.7	1.0	0.19	0.8	0.12	5.1	7.12	30.3	27.4	33.9	0.40	0.7	0.17
Bromide	mg/L	a	a	a	a	0.306	a	a	5.21	6.21	a	a	a	a
Calcium	mg/L	66.4	8.4	9.10	185.0	191.3	85.7	123.3	50.6	93.3	159.0	39.4	17.6	87.3
Carbonate	mg/L	0.141	0.001	0.03402	0.034	0.00419	a	a	a	a	a	a	a	a
Chloride	mg/L	1968	8	4.97	29	188	2	2.80	1159	1296	4	1.66	1	2.41
Conductivity	µmhos/cm	6310	300	294	1653	1865	4620	6170	5760	6150	4820	1186	617	4280
Copper	mg/L	a	0.05	a	0.06	a	a	0.02	0.03	a	0.19	a	0.01	a
Fluoride	mg/L	3.62	4.25	1.79	0.716	0.910	0.495	0.526	a	a	0.399	a	0.368	0.479
Hydroxide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	mg/L	1.59	a	1.13	a	a	51.9	92.8	8.0	2.72	47.5	53.8	4.5	24.1
Lithium	mg/L	12.3	0.04	a	0.12	a	0.08	0.003	3.41	36.8	0.16	a	0.03	a
Magnesium	mg/L	6.90	0.72	0.58	0.76	1.16	29	50.2	14	19.0	81	26.8	14	22.9
Manganese	mg/L	0.35	0.09	0.03	1.03	0.43	1.90	2.40	1.20	8.50	8.22	0.62	0.85	1.97
Mercury	mg/L	a	a	a	a	a	a	a	a	a	a	a	a	a
pH	pH units	7.16	6.22	6.82	6.46	7.14	2.34	2.28	2.50	2.58	2.57	3.05	3.50	2.54
Potassium	mg/L	245	17.9	17.3	99.7	146	35.3	51.1	122	234	51.9	37.9	36.3	47.5
Selenium	mg/L	a	a	a	0.12	a	0.07	a	0.042	a	0.243	a	0.02	0.15
Silica	mg/L	38.8	197	208	117	106	281	234	287	342	442	281	276	284
Sodium	mg/L	2594	42	92.4	188	334	39	78.3	657	1424	61	26.7	42	149
Strontium	mg/L	2.94	0.139	a	1.75	1.14	0.178	0.2	0.197	0.27	0.095	0.06	0.132	0.07
Sulfate	mg/L	94.1	83	82.3	705	889	1114	1754	548	710	2488	577	235	1398
TDS	mg/L	3302	436	453	1608	1641	1558	1795	2913	2892	3830	911	745	1814
Thallium	mg/L	0.06	a	a	a	a	a	a	0.013	0.10	a	0.10	a	0.08
Zinc	mg/L	0.03	0.48	a	a	0.89	0.079	a	0.05	0.19	1.18	0.05	0.054	a

Note:
a = none detected

TABLE 7. Chemical Analysis of Coso Area Surface and Near-Surface Thermal Waters.

TEMPERATURE RECORDINGS OF THE COSO RESORT AREA WELLS

The temperature logs from wells 4K-1, 4P-1, and Coso No. 1 are graphed in Figure 21, with the data listed in Tables 8 through 10. These data were recorded using the TD Probe System, manufactured by Natural Progress Instruments, Dallas, Texas.

TABLE 8. Temperature Recordings at Well 4K-1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3658	205.6
-5	3653	205.6
-10	3648	205.6
-15	3643	205.6
-20	3638	205.6
-25	3633	205.6
-30	3628	205.6
-35	3623	205.6
-40	3618	205.6
-45	3613	205.6
-50	3608	205.6
-51	3607	205.7
-52	3606	205.6
-53	3605	205.6
-54	3604	206.8
-55	3603	206.6
-56	3602	208.0
-57	3601	209.3
-58	3600	209.5
-59	3599	209.9
-60	3598	210.1
-65	3593	212.7
-70	3588	212.9
-75	3583	214.1
-80	3578	214.9

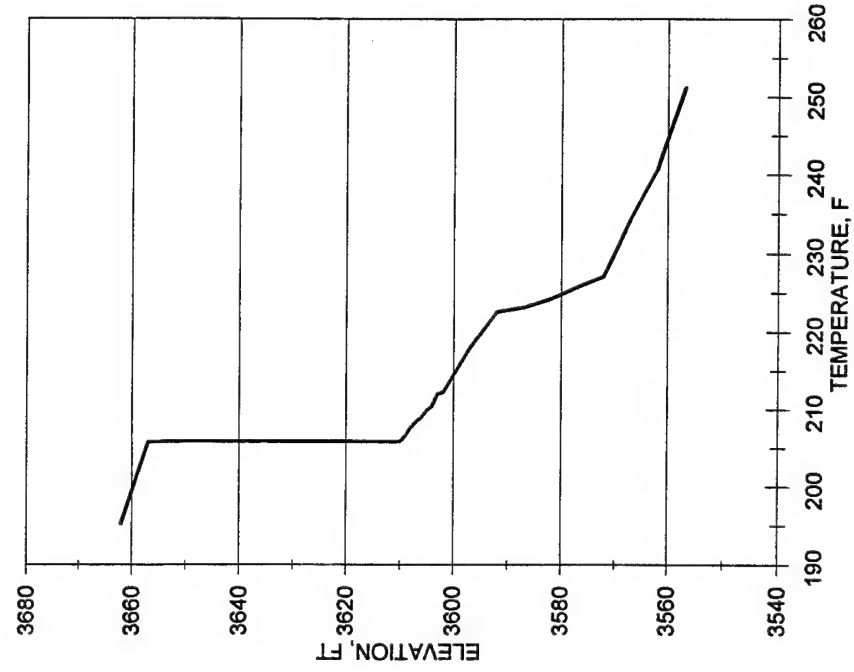
TABLE 9. Temperature Recordings at Well 4P-1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3662	195.3
-5	3657	205.8
-10	3652	205.9
-15	3647	205.9
-20	3642	205.9
-25	3637	205.9
-30	3632	205.9
-35	3627	205.9
-40	3622	205.9
-45	3617	205.9
-50	3612	205.9
-51	3611	205.9
-52	3610	205.9
-53	3609	206.7
-54	3608	207.7
-55	3607	208.5
-56	3606	209.0
-57	3605	209.9
-58	3604	210.4
-59	3603	212.0
-60	3602	212.3
-65	3597	218.1
-70	3592	222.6
-75	3587	223.2
-80	3582	224.3
-85	3577	225.8
-90	3572	227.2
-95	3567	234.5
-100	3562	240.8
-105	3557	251.3

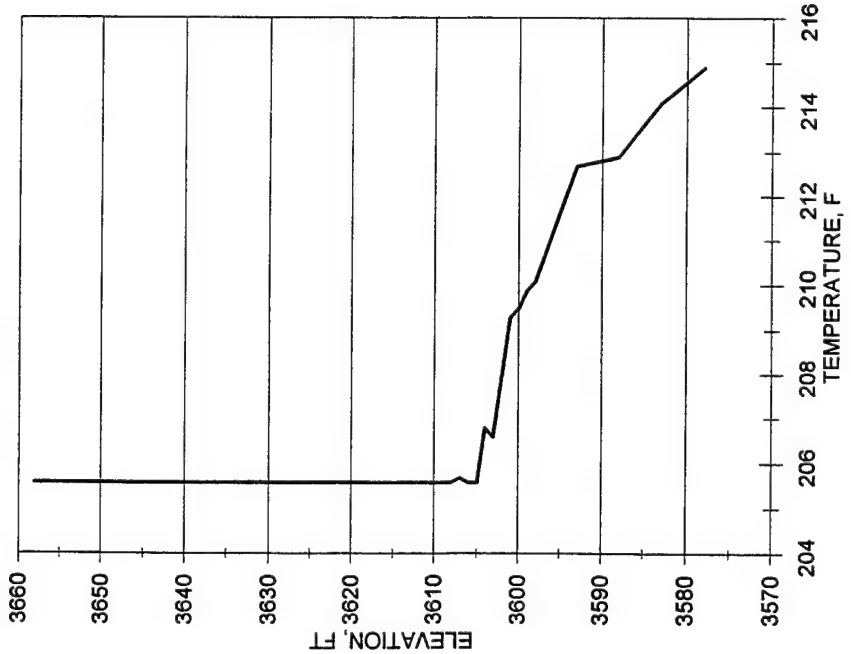
TABLE 10. Temperature Recordings at Coso No. 1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3615	253.6
-10	3605	253.8
-20	3595	256.0
-30	3585	256.0
-40	3575	256.0
-50	3565	256.0
-60	3555	256.0
-70	3545	256.0
-80	3535	256.0
-90	3525	256.0
-100	3515	256.0
-110	3505	256.0
-120	3495	256.0
-130	3485	256.0
-140	3475	256.2
-150	3465	256.2
-160	3455	256.2
-170	3445	256.2
-180	3435	256.2
-190	3425	256.2
-200	3415	256.2
-210	3405	256.2
-220	3395	256.2
-230	3385	256.2
-240	3375	256.2
-250	3365	256.2
-260	3355	256.2
-270	3345	256.2
-280	3335	256.2
-290	3325	256.2
-300	3315	256.2
-305	3310	257.2
-310	3305	257.2
-315	3300	257.2
-320	3295	257.2
-321	3294	258.0
-322	3293	258.8
-323	3292	259.5
-324	3291	260.0
-325	3290	261.1
-326	3289	261.6
-327	3288	262.2
-328	3287	262.5
-329	3286	262.7
-330	3285	262.7
-331	3284	262.7
-332	3283	262.7
-335	3282	263.3
-340	3281	264.1
-345	3276	266.2
-350	3271	267.1
-355	3266	267.6
-360	3261	268.0

FIGURE 21. Temperature Profiles

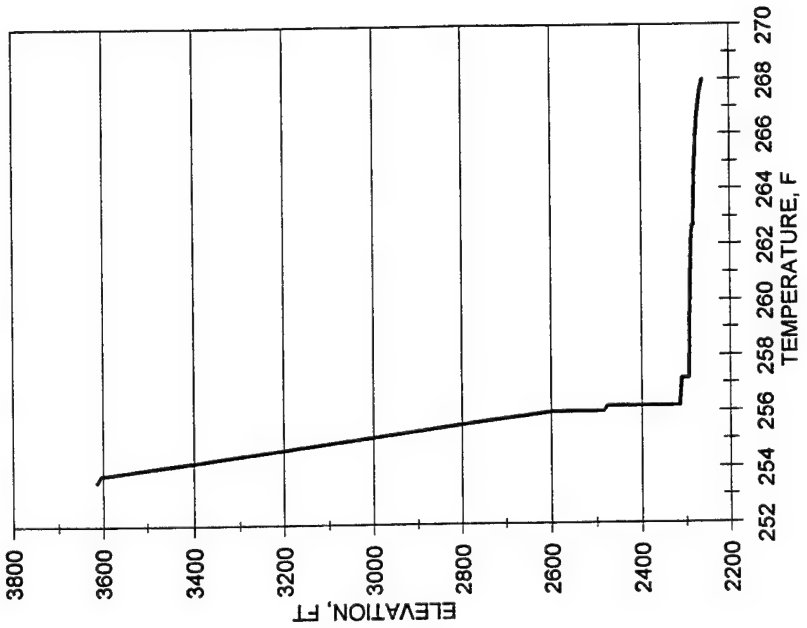


b. Well 4P-1 Temperature Gradient Log.



a. Well 4K-1 Temperature Gradient Log.

FIGURE 21. Temperature Profiles.



c. Coso No. 1 Temperature Gradient Log.

FIGURE 21. (Contd.)

OTHER GEOTHERMAL ACTIVITY AT COSO HOT SPRINGS

WEST CANYONS

The two west canyons are located approximately 0.7 km west of the Coso Resort area and on a course perpendicular to the strike-slip fault that runs north and south through the Coso Hot Springs area.

The southerly canyon, which has rain station No. 2 located at the west end, consists of hydrothermal alteration and scattered thermal activity both in the canyon and a wide area at the mouth of the canyon. The geology of this canyon indicates an extensive history of fluctuating thermal activities and features. The prominent area of present activity in the canyon includes an active steam vent bordering a vigorously boiling pool. At a greater distance up the canyon are two diminutive steam vents, small springs and fossil hot spring terrace deposits. Thermal activity in these areas is sporadic, depending upon climatic conditions. Some notable changes in the level of thermal activity have occurred here during this reporting period. An increase in the fluid discharge from the west canyon area has been noted. At first blush it would appear that this is most likely a run-off contribution from the increase in rainfall in the area during the reporting period. However, it has been demonstrated using geochemistry (both elemental and stable isotope) that the water levels in the shallow pools of the Coso Hot Springs area are not significantly affected by local rainfall.

We have no isotope data from these waters for this reporting period, but we do have two chemical analyses from March and August 1997 (Table 7). Comparing the August sample with analyses from both the March sample and samples from the past two years (NAWS-CL TP 007 and NAWS-CL TP 008) indicates a drop in the pH of the fluid (increasing acidity) coupled with a marked rise in sulfate, conductivity, TDS, and iron. Throughout this three-year period the amount of silica dissolved in the fluid has remained essentially constant. There also appears to be a small to moderate increase in the concentration of several anions and cations in the August 1997 sample.

These data imply a couple of different activities. The drop in pH coupled with the increase in sulfate can be caused by an increase of steam/non-condensable gas (H_2S and CO_2) flow into this thermal area. The increase in gas activity (bubbling in the mud/water mixture in the pool) would promote an increase in the anion/cation content of the water. Silica concentrations stay about the same because the temperature of the water doesn't vary significantly.

It is equally likely, however, that these same changes in the chemistry could be caused by rainwater collecting in the canyon, running over and percolating through the old, but hot, thermal mineral deposits, and dissolving some of the minerals. Next year's water analysis, which we will take in the spring and fall and which will include stable isotope analyses, may help to clarify the source or sources of this increased discharge.

The northerly west canyon holds an extensive area of hydrothermal alteration and fossil hot spring deposits. Present thermal activity is limited to warm-to-hot ground with a small number of steam vents. The earth slump, first noted in NAWS-CL TP 001, has continued to stabilize during the past year. Much of the slump area is warm-to-hot, with steam emanating from multiple vents, specifically along the face of the slump. The small pools of mud and steam condensate, noted in last year's summary are still present to the west of the slump.

As a whole, these sites appear to be largely unchanged from last year. One of the indicators of newly heated ground is the die-off of vegetation. The distribution of plant life in these canyons has stayed essentially unchanged.

DISCUSSION AND SUMMARY

The data recovered from each of the steam flow monitoring sites: Devils Kitchen, well 4H-4, and Schober's Resort have been considerably less erratic during the past three years than the data recovered prior to 1994. This is primarily due to the new recording equipment and a formal periodic maintenance and calibration schedule.

The water level in well 4P-1 has risen 21 feet since the beginning of the monitoring program in 1978. Most of this water level rise occurred since 1989 and seems to have stabilized at 3613.3 feet ASL. The water in this well is predominately a steam condensate and probably represents a small perched water table.

In contrast to well 4P-1 and OB-2, the water level in well OB-1 continues to drop slightly. Well OB-1 is located adjacent to the south side of Coso Wash and is clearly set in valley fill sediments, so it is unclear why the level has dropped some 40 feet since 1988. While water analyses indicate a partial geothermal fluid component, the predominant water source is clearly inflow of meteoric water from the mountains to the north and east. The groundwater around well OB-1 may still be responding to relatively low rainfall conditions in the region from 1985 through 1990, or the groundwater may just be seeking equilibrium with groundwater on the north side of the wash (represented by well OB-2).

As discussed in previous monitoring reports, the water level in Coso No. 1 is clearly influenced by the thermal activity along the hot springs fault. The level has dropped about 175 feet since 1984 due to a significant influx of heat and boiling-off of water. Since the wellhead was repaired and the well shut in, the water level appears to have stabilized.

There has been no significant change in thermal activity at the South Pool this past year. The water level continues to fluctuate seasonally, as does the water temperature, which exhibits about a ten degree (F) seasonal variation.

Additional observations:

During this reporting period, the central Coso Fault thermal area has changed moderately. The thermal area includes the old corrosion array, the Coso Resort mudfield, the South Pool, and the smaller pool and pots in between. While no new manifestation such as mud pots have formed here, the existing mud pots, craters, and fumeroles have enlarged somewhat in size. This seems to especially true just south of the South Pool where the existing mud pots not only have increased in size, the amount of fluid in the pots appears to have increased also. The Geothermal Program Office is continuing to closely monitor these changes.

The surface ground temperatures at hot spots both around the Upper Coso Wash Valley and along the periphery of the Coso Fault system have remained stable during the monitoring period. A hot spot is identified by warm-to-hot near-surface temperatures, discolored (cooked) soil, and/or die-off of vegetation. The shallow-rooted grasses, scrubs, and deep-rooted creosote bushes that have grown in these hot spots have remained the same since the last monitoring period.

This year's data, particularly that from the surface pools, pots, fumaroles, and hot spots, indicate seasonal fluctuation in temperatures and water levels; no significant increase or decrease of activity is occurring or has occurred during this monitoring period. Continuance of this monitoring program will enable us to determine if this stable trend continues.

NEW WORK

For the reporting period of 1997/98 there will be new data loggers for the tipping bucket rain gauges. The previous data loggers were out-dated and becoming unreliable. The new data loggers are all electronic and the data can be read directly into the office PC and sent to a spreadsheet where graphs can be made.

REFERENCES

1. Naval Air Weapons Station. Coso Monitoring Program, October 1993 Through September 1994, by S. C. Bjornstad, Public Works Department, J. H. Monahan, J. K. Sprouse and D. M. White, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, January 1995. 106 pp. (NAWS-CL TP 006, publication UNCLASSIFIED.)

2. _____. Coso Monitoring Program, October 1991 Through September 1992, by J. H. Monahan and K. L. Larson, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, December 1992. 123 pp. (NAWS-CL TP 001, publication UNCLASSIFIED.)

Appendix

DAILY STEAM FLOW

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
10/01/96	298	290	293
10/02/96	292	285	288
10/03/96	287	285	285
10/04/96	290	281	284
10/05/96	291	281	285
10/06/96	287	280	283
10/07/96	287	280	283
10/08/96	291	281	284
10/09/96	297	290	293
10/10/96	292	285	288
10/11/96	297	290	293
10/12/96	292	286	288
10/13/96	295	285	289
10/14/96	287	282	284
10/15/96	300	285	292
10/16/96	298	290	293
10/17/96	282	280	280
10/18/96	306	280	287
10/19/96	307	280	291
10/20/96	282	275	278
10/21/96	282	256	271
10/22/96	295	266	277
10/23/96	303	300	301
10/24/96	307	290	298
10/25/96	310	300	304
10/26/96	297	275	285
10/27/96	287	275	280
10/28/96	297	285	288
10/29/96	297	287	287
10/30/96	297	295	295
10/31/96	302	270	283
11/01/96	300	280	287
11/02/96	287	280	283
11/03/96	305	285	294
11/04/96	302	290	295
11/05/96	302	285	290
11/06/96	287	277	282
11/07/96	282	275	278
11/08/96	292	280	285
11/09/96	302	290	295
11/10/96	302	300	300
11/11/96	297	295	295
11/12/96	290	285	287
11/13/96	297	292	294
11/14/96	313	300	308
11/15/96	317	290	303
11/16/96	287	285	285
11/17/96	292	285	288
11/18/96	292	280	285
11/19/96	298	287	294
11/20/96	297	280	288
11/21/96	296	289	292
11/22/96	298	287	293

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
10/01/96	926	912	915
10/02/96	926	912	915
10/03/96	926	905	912
10/04/96	926	905	912
10/05/96	926	905	912
10/06/96	923	905	911
10/07/96	926	905	912
10/08/96	926	905	912
10/09/96	926	905	912
10/10/96	926	908	914
10/11/96	926	905	912
10/12/96	923	908	912
10/13/96	919	905	909
10/14/96	923	905	911
10/15/96	919	905	909
10/16/96	926	905	912
10/17/96	923	906	912
10/18/96	926	905	912
10/19/96	926	908	915
10/20/96	923	905	914
10/21/96	910	901	903
10/22/96	910	881	894
10/23/96	910	889	897
10/24/96	926	912	915
10/25/96	934	920	925
10/26/96	938	920	926
10/27/96	910	897	901
10/28/96	926	889	905
10/29/96	923	905	909
10/30/96	929	905	914
10/31/96	934	905	915
11/01/96	929	920	922
11/02/96	926	905	912
11/03/96	938	920	926
11/04/96	935	920	925
11/05/96	938	920	926
11/06/96	926	905	912
11/07/96	923	912	914
11/08/96	926	905	912
11/09/96	930	919	922
11/10/96	938	922	928
11/11/96	943	922	929
11/12/96	941	933	934
11/13/96	957	920	936
11/14/96	957	936	944
11/15/96	945	936	937
11/16/96	941	933	934
11/17/96	941	933	934
11/18/96	941	928	931
11/19/96	941	920	928
11/20/96			
11/21/96			
11/22/96			

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
10/01/96	509	495	502
10/02/96	506	491	498
10/03/96	503	489	496
10/04/96	508	489	499
10/05/96	508	489	499
10/06/96	504	489	497
10/07/96	508	485	498
10/08/96	510	489	499
10/09/96	511	489	501
10/10/96	508	489	499
10/11/96	508	488	498
10/12/96	510	492	499
10/13/96	508	489	499
10/14/96	506	491	498
10/15/96	503	489	496
10/16/96	508	492	501
10/17/96	510	494	502
10/18/96	511	484	498
10/19/96	514	491	502
10/20/96	512	496	505
10/21/96	497	483	487
10/22/96	488	471	479
10/23/96	508	484	498
10/24/96	514	495	505
10/25/96	519	496	507
10/26/96	519	492	506
10/27/96	503	477	488
10/28/96	500	472	490
10/29/96	504	484	495
10/30/96	503	492	497
10/31/96	508	484	497
11/01/96	503	478	490
11/02/96	501	478	489
11/03/96	514	489	502
11/04/96	513	491	501
11/05/96	507	491	499
11/06/96	503	489	496
11/07/96	503	452	483
11/08/96	508	484	496
11/09/96	514	492	502
11/10/96	514	495	505
11/11/96	508	492	502
11/12/96	507	489	498
11/13/96	513	495	504
11/14/96	515	506	510
11/15/96	520	489	507
11/16/96	503	488	496
11/17/96	504	489	497
11/18/96	507	485	497
11/19/96	514	492	502
11/20/96	508	484	498
11/21/96	507	491	499
11/22/96	510	490	500

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
11/23/96	282	270	275
11/24/96	282	270	275
11/25/96	292	280	285
11/26/96	290	276	285
11/27/96	287	280	283
11/28/96	324	285	303
11/29/96	302	282	292
11/30/96	277	275	275
12/01/96	302	280	290
12/02/96	287	280	283
12/03/96	292	270	280
12/04/96	287	280	283
12/05/96	317	285	300
12/06/96	317	282	298
12/07/96	277	274	275
12/08/96	295	276	290
12/09/96	302	295	298
12/10/96	297	290	293
12/11/96	291	280	285
12/12/96	288	282	284
12/13/96	287	280	283
12/14/96	277	275	275
12/15/96	277	272	274
12/16/96	301	286	292
12/17/96	297	280	288
12/18/96	287	280	283
12/19/96	297	290	292
12/20/96	309	292	300
12/21/96	317	306	311
12/22/96	305	282	288
12/23/96	280	260	267
12/24/96	283	265	274
12/25/96	302	287	293
12/26/96	295	280	290
12/27/96	305	295	300
12/28/96	299	291	294
12/29/96	285	281	282
12/30/96	287	279	283
12/31/96	288	285	287
01/01/97	288	280	283
01/02/97	284	284	283
01/03/97	306	300	302
01/04/97	297	277	288
01/05/97	287	280	283
01/06/97	295	290	291
01/07/97	282	251	270
01/08/97	287	252	272
01/09/97	287	281	285
01/10/97	292	290	290
01/11/97	312	304	308
01/12/97	312	311	311
01/13/97	307	282	291
01/14/97	280	269	272

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
11/23/96			
11/24/96			
11/25/96			
11/26/96			
11/27/96	926	905	912
11/28/96	957	920	936
11/29/96	934	920	925
11/30/96	924	912	915
12/01/96	934	917	925
12/02/96	926	905	912
12/03/96	926	912	915
12/04/96	926	917	919
12/05/96	949	920	931
12/06/96	941	925	931
12/07/96	935	926	928
12/08/96	927	920	920
12/09/96	927	920	920
12/10/96	927	920	920
12/11/96	926	905	912
12/12/96	934	912	920
12/13/96	930	912	920
12/14/96	930	920	922
12/15/96	926	917	917
12/16/96	937	915	925
12/17/96	935	912	920
12/18/96	926	917	919
12/19/96	930	920	922
12/20/96	941	920	928
12/21/96	941	920	928
12/22/96	957	936	944
12/23/96	949	936	940
12/24/96	945	933	936
12/25/96	957	936	944
12/26/96	970	951	958
12/27/96	973	954	961
12/28/96	970	951	958
12/29/96	957	948	950
12/30/96	963	948	953
12/31/96	957	948	950
01/01/97	957	948	950
01/02/97	957	948	950
01/03/97	989	967	975
01/04/97	976	967	968
01/05/97	976	964	967
01/06/97	976	951	961
01/07/97	957	944	944
01/08/97	967	948	958
01/09/97	973	964	965
01/10/97	974	964	967
01/11/97	985	967	973
01/12/97	989	970	976
01/13/97	989	979	981
01/14/97	981	967	972

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
11/23/96	497	478	487
11/24/96	500	478	489
11/25/96	503	489	496
11/26/96	501	487	493
11/27/96	500	484	491
11/28/96	527	495	510
11/29/96	498	484	491
11/30/96	490	478	485
12/01/96	507	484	493
12/02/96	497	455	476
12/03/96	503	489	496
12/04/96	503	484	493
12/05/96	516	495	505
12/06/96	507	484	495
12/07/96	491	478	485
12/08/96	503	484	493
12/09/96	507	483	495
12/10/96	504	488	495
12/11/96	496	483	487
12/12/96	497	483	491
12/13/96	497	484	490
12/14/96	492	480	486
12/15/96	497	478	489
12/16/96	510	489	499
12/17/96	501	488	495
12/18/96	508	484	496
12/19/96	508	487	499
12/20/96	513	491	501
12/21/96	514	501	509
12/22/96	508	486	498
12/23/96	482	467	474
12/24/96	497	478	487
12/25/96	508	484	496
12/26/96	508	489	499
12/27/96	507	495	501
12/28/96	505	489	497
12/29/96	497	484	490
12/30/96	499	484	491
12/31/96	501	489	495
01/01/97	500	488	495
01/02/97	494	484	489
01/03/97	514	495	505
01/04/97	511	491	502
01/05/97	503	487	495
01/06/97	503	483	491
01/07/97	491	467	479
01/08/97	497	481	490
01/09/97	498	489	494
01/10/97	501	487	494
01/11/97	519	489	506
01/12/97	519	495	505
01/13/97	513	501	507
01/14/97	511	484	500

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	276	265	269
01/16/97	272	265	268
01/17/97	278	275	276
01/18/97	278	275	276
01/19/97	292	280	285
01/20/97	302	292	295
01/21/97	302	293	296
01/22/97	296	291	293
01/23/97	300	292	296
01/24/97	292	290	290
01/25/97	287	280	283
01/26/97	293	291	291
01/27/97	297	276	287
01/28/97	272	270	270
01/29/97	286	271	279
01/30/97	288	280	285
01/31/97	290	281	285
02/01/97	298	285	292
02/02/97	297	290	293
02/03/97	297	280	288
02/04/97	287	280	283
02/05/97	296	290	292
02/06/97	280	276	277
02/07/97	286	277	280
02/08/97	295	285	288
02/09/97	294	285	288
02/10/97	312	295	300
02/11/97	290	282	283
02/12/97	288	257	263
02/13/97	280	276	275
02/14/97	286	277	278
02/15/97	295	282	285
02/16/97	282	280	285
02/17/97	292	285	288
02/18/97	290	285	286
02/19/97	295	275	284
02/20/97	322	309	315
02/21/97	290	262	274
02/22/97	267	257	261
02/23/97	295	274	285
02/24/97	301	275	286
02/25/97	272	265	268
02/26/97	264	264	263
02/27/97	278	270	274
02/28/97	274	265	271
03/01/97	296	285	290
	287	280	284
03/03/97	287	280	284
03/04/97	297	285	290
03/05/97	305	300	302
03/06/97	298	285	289
03/07/97	295	290	291
03/08/97	286	276	283

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	973	951	959
01/16/97	960	951	953
01/17/97	960	951	953
01/18/97	957	944	948
01/19/97	957	944	948
01/20/97	957	940	947
01/21/97	954	940	944
01/22/97	957	939	945
01/23/97	959	950	951
01/24/97	960	951	953
01/25/97	957	950	951
01/26/97	960	950	951
01/27/97	957	948	950
01/28/97	960	951	953
01/29/97	957	948	950
01/30/97	957	936	944
01/31/97	957	936	944
02/01/97	957	945	948
02/02/97	957	948	950
02/03/97	957	948	950
02/04/97	960	951	953
02/05/97	962	950	953
02/06/97	973	951	959
02/07/97	957	948	950
02/08/97	957	948	950
02/09/97	960	951	953
02/10/97	960	951	953
02/11/97	970	951	958
02/12/97	973	953	959
02/13/97	960	947	951
02/14/97	960	948	951
02/15/97	957	948	950
02/16/97	971	951	958
02/17/97	981	954	965
02/18/97	956	936	942
02/19/97	954	944	947
02/20/97	992	967	975
02/21/97	973	951	958
02/22/97	960	947	950
02/23/97	959	950	951
02/24/97	959	944	947
02/25/97	963	951	954
02/26/97	960	951	953
02/27/97	957	942	945
02/28/97	962	939	944
03/01/97	952	939	942
03/02/97	954	942	945
03/03/97	949	936	939
03/04/97	956	939	944
03/05/97	965	947	953
03/06/97	963	951	954
03/07/97	976	958	962
03/08/97	976	964	967

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	519	497	508
01/16/97	491	477	485
01/17/97	494	481	487
01/18/97	494	478	486
01/19/97	506	484	497
01/20/97	500	481	490
01/21/97	487	475	481
01/22/97	503	479	488
01/23/97	491	479	486
01/24/97	498	484	491
01/25/97	498	483	490
01/26/97	501	490	496
01/27/97	508	489	499
01/28/97	507	489	498
01/29/97	503	489	496
01/30/97	497	484	490
01/31/97	504	484	494
02/01/97	508	491	501
02/02/97	508	492	501
02/03/97	503	488	495
02/04/97	503	484	493
02/05/97	503	491	497
02/06/97	500	489	495
02/07/97	492	479	486
02/08/97	497	484	490
02/09/97	501	489	495
02/10/97	493	483	487
02/11/97	500	485	493
02/12/97	500	489	495
02/13/97	494	475	485
02/14/97	496	481	489
02/15/97	495	485	490
02/16/97	501	488	495
02/17/97	514	483	499
02/18/97	492	471	481
02/19/97	491	477	483
02/20/97	498	479	489
02/21/97	503	489	497
02/22/97	497	480	489
02/23/97	498	479	490
02/24/97	504	474	488
02/25/97	495	476	483
02/26/97	511	485	490
02/27/97	517	489	502
02/28/97	497	475	485
03/01/97	488	470	479
03/02/97	497	480	489
03/03/97	499	484	492
03/04/97	490	472	482
03/05/97	486	477	482
03/06/97	506	485	494
03/07/97	499	489	495
03/08/97	498	484	491

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
03/09/97	280	271	274
03/10/97	297	277	287
03/11/97	302	295	297
03/12/97	289	290	289
03/13/97	286	280	283
03/14/97	297	285	288
03/15/97	297	292	295
03/16/97	291	282	284
03/17/97	275	265	269
03/18/97	272	260	265
03/19/97	273	267	269
03/20/97	302	289	293
03/21/97	295	293	293
03/22/97	297	287	292
03/23/97	294	289	289
03/24/97	284	275	277
03/25/97	282	272	275
03/26/97	282	280	280
03/27/97	298	290	293
03/28/97	292	280	287
03/29/97	282	270	275
03/30/97	293	277	285
03/31/97	292	282	284
04/01/97	284	275	280
04/02/97	287	282	284
04/03/97	288	282	284
04/04/97	301	285	288
04/05/97	308	290	298
04/06/97	281	274	276
04/07/97	283	274	278
04/08/97	296	280	287
04/09/97	287	276	283
04/10/97	285	280	281
04/11/97	287	275	279
04/12/97	282	275	276
04/13/97	287	276	282
04/14/97	286	280	281
04/15/97	282	275	277
04/16/97	287	276	284
04/17/97	282	275	279
04/18/97	291	280	284
04/19/97	280	279	278
04/20/97	281	267	273
04/21/97	288	275	283
04/22/97	287	275	280
04/23/97	295	289	289
04/24/97	286	277	278
04/25/97	277	266	271
04/26/97	279	265	273
04/27/97	293	277	285
04/28/97	291	280	283
04/29/97	280	271	274
04/30/97	272	270	270

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
03/09/97	973	959	962
03/10/97	967	954	958
03/11/97	974	958	962
03/12/97	973	964	965
03/13/97	985	968	975
03/14/97	989	975	978
03/15/97	989	976	979
03/16/97	985	978	979
03/17/97	973	964	965
03/18/97	970	959	962
03/19/97	970	961	962
03/20/97	989	968	975
03/21/97	985	975	976
03/22/97	984	970	973
03/23/97	984	967	972
03/24/97	978	965	968
03/25/97	973	962	965
03/26/97	985	967	973
03/27/97	985	972	975
03/28/97	981	967	970
03/29/97	971	954	959
03/30/97	973	959	962
03/31/97	971	951	959
04/01/97	957	944	947
04/02/97	957	944	945
04/03/97	973	951	959
04/04/97	985	959	968
04/05/97	970	954	959
04/06/97	967	951	954
04/07/97	973	954	959
04/08/97	974	959	964
04/09/97	973	959	962
04/10/97	970	958	961
04/11/97	968	951	958
04/12/97	951	942	944
04/13/97	965	951	954
04/14/97	970	954	959
04/15/97	967	948	954
04/16/97	973	961	962
04/17/97	970	951	961
04/18/97	985	970	973
04/19/97	989	975	978
04/20/97	978	968	970
04/21/97	979	967	970
04/22/97	985	968	973
04/23/97	985	967	972
04/24/97	987	975	978
04/25/97	970	959	961
04/26/97	973	956	959
04/27/97	981	967	972
04/28/97	982	967	972
04/29/97	976	967	968
04/30/97	973	967	967

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
03/09/97	492	478	487
03/10/97	503	484	493
03/11/97	508	494	501
03/12/97	503	489	496
03/13/97	498	484	491
03/14/97	504	487	495
03/15/97	504	493	498
03/16/97	503	484	494
03/17/97	491	478	485
03/18/97	491	475	483
03/19/97	490	480	485
03/20/97	508	491	500
03/21/97	503	492	497
03/22/97	503	489	496
03/23/97	500	487	493
03/24/97	496	483	489
03/25/97	493	478	485
03/26/97	492	484	488
03/27/97	503	491	496
03/28/97	499	478	490
03/29/97	490	477	483
03/30/97	501	483	491
03/31/97	497	485	491
04/01/97	493	478	486
04/02/97	491	479	485
04/03/97	503	484	494
04/04/97	507	485	495
04/05/97	492	478	484
04/06/97	485	475	479
04/07/97	489	478	484
04/08/97	497	484	491
04/09/97	498	489	494
04/10/97	497	478	489
04/11/97	498	477	488
04/12/97	492	478	485
04/13/97	493	482	487
04/14/97	493	483	487
04/15/97	491	481	486
04/16/97	492	482	487
04/17/97	491	484	487
04/18/97	492	479	486
04/19/97	493	478	485
04/20/97	489	477	483
04/21/97	492	478	483
04/22/97	492	480	486
04/23/97	497	485	491
04/24/97	496	479	489
04/25/97	486	471	479
04/26/97	492	479	477
04/27/97	497	483	490
04/28/97	495	483	489
04/29/97	491	478	483
04/30/97	486	478	482

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	288	282	283
05/02/97	282	275	278
05/03/97	282	270	275
05/04/97	282	271	274
05/05/97	285	275	279
05/06/97	287	280	280
05/07/97	280	281	279
05/08/97	282	275	278
05/09/97	282	275	276
05/10/97	286	275	279
05/11/97	291	280	283
05/12/97	288	284	284
05/13/97	290	282	284
05/14/97	282	281	280
05/15/97	283	275	278
05/16/97	277	275	275
05/17/97	288	280	283
05/18/97	287	285	285
05/19/97	287	284	283
05/20/97	288	283	284
05/21/97	278	280	278
05/22/97	282	281	281
05/23/97	295	285	289
05/24/97	288	286	286
05/25/97	287	282	284
05/26/97	281	280	280
05/27/97	274	263	268
05/28/97	282	274	277
05/29/97	291	282	284
05/30/97	292	285	288
05/31/97	287	282	284
06/01/97	291	280	284
06/02/97	296	285	290
06/03/97	292	290	290
06/04/97	288	284	283
06/05/97	287	275	280
06/06/97	299	288	292
06/07/97	291	285	287
06/08/97	283	280	281
06/09/97	282	280	280
06/10/97	283	275	278
06/11/97	282	275	278
06/12/97	285	280	281
06/13/97	303	287	292
06/14/97	282	270	275
06/15/97	272	272	271
06/16/97	280	273	274
06/17/97	282	275	278
06/18/97	287	276	282
06/19/97	292	275	283
06/20/97	302	285	293
06/21/97	297	285	290
06/22/97	293	284	283

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	981	970	973
05/02/97	979	967	970
05/03/97	973	964	965
05/04/97	973	964	965
05/05/97	973	962	964
05/06/97	974	961	965
05/07/97	971	962	964
05/08/97	976	962	965
05/09/97	973	964	965
05/10/97	971	964	964
05/11/97	973	964	965
05/12/97	973	962	965
05/13/97	973	965	964
05/14/97	971	964	965
05/15/97	974	958	967
05/16/97	967	953	959
05/17/97	967	954	956
05/18/97	970	954	959
05/19/97	968	954	958
05/20/97	967	954	959
05/21/97	960	951	953
05/22/97	973	944	956
05/23/97	960	951	953
05/24/97	957	936	944
05/25/97	941	933	934
05/26/97	951	936	940
05/27/97	948	936	940
05/28/97	954	948	945
05/29/97	948	936	939
05/30/97	954	939	944
05/31/97	951	936	940
06/01/97	948	933	938
06/02/97	948	936	939
06/03/97	945	936	937
06/04/97	941	933	934
06/05/97	941	933	934
06/06/97	941	928	931
06/07/97	951	929	937
06/08/97	945	936	937
06/09/97	945	936	937
06/10/97	941	933	934
06/11/97	941	933	934
06/12/97	941	933	934
06/13/97	954	936	942
06/14/97	941	923	929
06/15/97	938	929	931
06/16/97	940	922	928
06/17/97	941	931	933
06/18/97	943	933	934
06/19/97	954	920	934
06/20/97	976	951	959
06/21/97	989	976	979
06/22/97	973	951	959

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	492	483	487
05/02/97	491	479	485
05/03/97	487	478	482
05/04/97	491	478	485
05/05/97	491	479	485
05/06/97	492	480	486
05/07/97	490	479	485
05/08/97	488	478	483
05/09/97	486	478	482
05/10/97	490	477	484
05/11/97	491	479	485
05/12/97	490	479	484
05/13/97	491	479	491
05/14/97	490	479	485
05/15/97	491	478	485
05/16/97	486	476	481
05/17/97	495	476	484
05/18/97	491	480	486
05/19/97	489	479	484
05/20/97	496	479	487
05/21/97	486	478	482
05/22/97	492	476	484
05/23/97	491	478	485
05/24/97	490	479	485
05/25/97	490	476	483
05/26/97	488	477	483
05/27/97	485	471	479
05/28/97	485	472	479
05/29/97	492	477	484
05/30/97	492	479	485
05/31/97	487	477	482
06/01/97	491	475	483
06/02/97	492	478	485
06/03/97	491	479	485
06/04/97	489	477	483
06/05/97	486	472	479
06/06/97	491	467	479
06/07/97	485	467	476
06/08/97	482	472	478
06/09/97	485	472	479
06/10/97	482	471	477
06/11/97	480	471	475
06/12/97	490	472	481
06/13/97	493	478	486
06/14/97	491	467	479
06/15/97	480	466	473
06/16/97	478	464	471
06/17/97	480	467	474
06/18/97	480	470	474
06/19/97	490	472	481
06/20/97	491	474	482
06/21/97	494	478	486
06/22/97	491	477	484

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
06/23/97	291	278	278
06/24/97	282	270	275
06/25/97	282	270	275
06/26/97	286	280	282
06/27/97	288	275	281
06/28/97	287	275	280
06/29/97	291	277	283
06/30/97	292	280	285
07/01/97	287	276	281
07/02/97	282	262	271
07/03/97	285	275	279
07/04/97	287	276	280
07/05/97	287	275	280
07/06/97	291	277	281
07/07/97	291	275	280
07/08/97	288	280	283
07/09/97	287	279	282
07/10/97	286	275	280
07/11/97	292	275	283
07/12/97	302	290	295
07/13/97	297	289	292
07/14/97	282	280	280
07/15/97	277	270	273
07/16/97	272	264	262
07/17/97	276	264	269
07/18/97	293	286	289
07/19/97	297	281	288
07/20/97	288	285	286
07/21/97	287	279	282
07/22/97	286	276	280
07/23/97	282	275	278
07/24/97	277	266	271
07/25/97	288	280	283
07/26/97	293	280	286
07/27/97	297	290	293
07/28/97	297	289	292
07/29/97	297	285	290
07/30/97	292	285	288
07/31/97	292	285	288
08/01/97	291	283	286
08/02/97	288	279	280
08/03/97	292	280	285
08/04/97	296	285	290
08/05/97	292	285	288
08/06/97	292	280	285
08/07/97	294	281	287
08/08/97	297	276	286
08/09/97	298	290	293
08/10/97	297	289	292
08/11/97	297	285	290
08/12/97	290	280	284
08/13/97	287	280	283
08/14/97	284	280	281

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
06/23/97	941	920	928
06/24/97	910	889	897
06/25/97	919	892	903
06/26/97	926	905	912
06/27/97	926	908	914
06/28/97	926	911	915
06/29/97	923	905	911
06/30/97	929	908	915
07/01/97	926	911	915
07/02/97	916	905	908
07/03/97	923	901	909
07/04/97	926	905	912
07/05/97	923	908	914
07/06/97	926	905	912
07/07/97	926	905	912
07/08/97	918	905	909
07/09/97	913	901	905
07/10/97			
07/11/97			
07/12/97			
07/13/97			
07/14/97			
07/15/97			
07/16/97			
07/17/97	926	901	911
07/18/97	926	917	919
07/19/97	926	917	919
07/20/97	926	917	919
07/21/97	926	914	917
07/22/97	926	914	917
07/23/97	923	901	909
07/24/97	919	903	908
07/25/97	924	889	903
07/26/97	923	908	914
07/27/97	923	905	911
07/28/97	919	905	909
07/29/97	913	901	905
07/30/97	910	901	903
07/31/97	918	901	908
08/01/97	910	895	900
08/02/97	910	901	903
08/03/97	913	901	905
08/04/97	913	905	906
08/05/97	916	901	906
08/06/97	913	905	906
08/07/97	913	901	905
08/08/97	926	908	914
08/09/97	923	908	912
08/10/97	923	905	911
08/11/97	926	905	912
08/12/97	926	908	914
08/13/97	923	911	914
08/14/97	926	905	912

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
06/23/97	490	474	482
06/24/97	490	470	479
06/25/97	485	468	477
06/26/97	482	468	475
06/27/97	484	467	475
06/28/97	480	467	473
06/29/97	483	467	475
06/30/97	489	467	478
07/01/97	478	456	467
07/02/97	481	455	468
07/03/97	483	468	475
07/04/97	485	467	476
07/05/97	485	467	476
07/06/97	485	467	476
07/07/97	484	468	476
07/08/97	481	468	474
07/09/97	481	466	473
07/10/97	491	472	482
07/11/97	494	478	486
07/12/97	491	472	482
07/13/97	485	467	475
07/14/97	485	467	476
07/15/97	491	477	484
07/16/97	490	476	483
07/17/97	490	474	482
07/18/97	485	472	479
07/19/97	485	468	477
07/20/97	486	467	474
07/21/97	485	468	474
07/22/97	481	468	474
07/23/97	475	460	467
07/24/97	483	468	475
07/25/97	484	471	478
07/26/97	481	472	477
07/27/97	482	472	477
07/28/97	481	471	476
07/29/97	482	472	477
07/30/97	478	468	473
07/31/97	483	472	478
08/01/97	484	469	477
08/02/97	482	471	477
08/03/97	483	471	477
08/04/97	485	472	479
08/05/97	480	470	475
08/06/97	482	471	477
08/07/97	491	470	481
08/08/97	490	477	484
08/09/97	492	477	485
08/10/97	491	472	482
08/11/97	490	472	481
08/12/97	485	468	477
08/13/97	484	471	478
08/14/97	486	468	477

4H4 Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
08/15/97	297	285	290
08/16/97	306	287	292
08/17/97	292	285	288
08/18/97	287	276	281
08/19/97	288	276	282
08/20/97	287	280	283
08/21/97	292	280	285
08/22/97	287	281	280
08/23/97	289	284	284
08/24/97	293	285	288
08/25/97	292	285	288
08/26/97	293	282	288
08/27/97	291	275	286
08/28/97	296	284	285
08/29/97	297	284	290
08/30/97	292	281	287
08/31/97	293	285	287
09/01/97	297	280	290
09/02/97	288	270	283
09/03/97	277	272	274
09/04/97	282	275	273
09/05/97	289	275	278
09/06/97	289	275	280
09/07/97			
09/08/97			
09/09/97			
09/10/97			
09/11/97	297	281	288
09/12/97	298	290	295
09/13/97	291	285	287
09/14/97	283	280	281
09/15/97	283	271	276
09/16/97	287	275	280
09/17/97	284	276	279
09/18/97	292	280	284
09/19/97	297	290	293
09/20/97	290	282	284
09/21/97	287	275	280
09/22/97	273	265	268
09/23/97	275	265	269
09/24/97	283	274	276
09/25/97	292	279	284
09/26/97	298	291	294
09/27/97	293	271	279
09/28/97	288	281	286
09/29/97	287	276	281
09/30/97	295	279	285

Schobers Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
08/15/97	926	905	912
08/16/97	932	920	923
08/17/97	929	920	922
08/18/97	932	917	922
08/19/97	929	917	920
08/20/97	929	917	920
08/21/97	929	920	922
08/22/97	932	920	922
08/23/97	932	920	923
08/24/97	932	920	923
08/25/97	932	920	923
08/26/97	932	873	923
08/27/97	935	889	925
08/28/97	910	901	889
08/29/97	910	929	900
08/30/97	918	936	908
08/31/97	941	944	933
09/01/97	957	917	944
09/02/97	957	908	947
09/03/97	941	920	926
09/04/97	926	909	914
09/05/97	929	920	922
09/06/97	926	920	917
09/07/97	935	920	925
09/08/97	940	920	926
09/09/97	932	920	923
09/10/97	938	920	926
09/11/97	941	920	928
09/12/97	935	920	925
09/13/97	932	920	923
09/14/97	929	920	922
09/15/97	935	920	925
09/16/97	935	920	925
09/17/97	935	920	925
09/18/97	934	923	925
09/19/97	938	923	928
09/20/97	926	919	920
09/21/97	941	928	931
09/22/97	938	929	931
09/23/97	941	928	931
09/24/97	943	929	933
09/25/97	934	922	925
09/26/97	923	914	915
09/27/97	926	919	917
09/28/97	929	920	922
09/29/97	930	920	923
09/30/97	926	920	920

Devils Kitchen Steam Flow 10/96 through 9/97

DATE	High, lb/h	Low, lb/h	Avg, lb/h
08/15/97	491	472	482
08/16/97	491	475	483
08/17/97	488	472	482
08/18/97	485	468	477
08/19/97	486	468	477
08/20/97	486	470	478
08/21/97	490	472	481
08/22/97	485	468	477
08/23/97	490	472	481
08/24/97	491	472	482
08/25/97	490	472	481
08/26/97	490	474	482
08/27/97	488	473	481
08/28/97	527	495	507
08/29/97	532	512	522
08/30/97	529	512	520
08/31/97	529	511	521
09/01/97	526	511	518
09/02/97	526	507	516
09/03/97	525	508	516
09/04/97	520	505	513
09/05/97	525	512	518
09/06/97	520	508	514
09/07/97	520	511	516
09/08/97	525	511	518
09/09/97	520	511	516
09/10/97	520	511	519
09/11/97	529	509	523
09/12/97	530	517	518
09/13/97	525	511	509
09/14/97	523	508	513
09/15/97	522	505	513
09/16/97	526	501	513
09/17/97	519	507	513
09/18/97	536	518	525
09/19/97	530	515	522
09/20/97	524	509	517
09/21/97	531	512	521
09/22/97	527	512	519
09/23/97	529	513	521
09/24/97	530	515	521
09/25/97	535	517	526
09/26/97	531	516	523
09/27/97	529	512	520
09/28/97	532	518	524
09/29/97	532	522	527
09/30/97	530	520	525